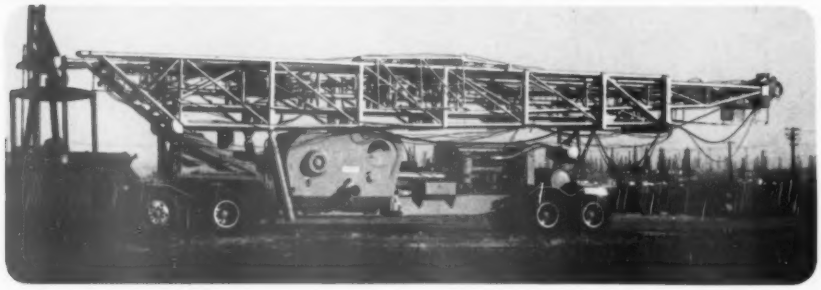
the OIL AND GAS JOURNAL

NEW TYPE GAS REPRESSURING
. . . starts on page 84

FRANKS SELF-PROPELLED CLIPPER

THE ... IS THE ANSWER TO A LEGAL RIG ON WHEELS FOR OUR HEAVY DUTY WORK . . .



Like the swift Yankee Clippers that sailed the Seven Seas and opened a new era in American shipping, the Franks "Clipper" Hoist ushers in a new period of efficient performance in heavy duty work with a self-propelled unit — FREE OF ANNOYING LEGAL RESTRAINT.

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Watching an athlete top a sports record, you feel a glow of admiration for the high degree of control and coordination which he has over his well trained muscles. And in oil well casing perforating, the same as in sports, it is the effectiveness of the techniques developed and the skill in applying them that get results. Welex Jet perforating, unlike the older methods which it is replacing, is not a method of violently upsetting an assembly in the well to permit the entry of oil. Rather it is *formation* perforating, which produces *through an intact assembly* with *positive hole density per foot* and *known penetration*. Results cost less with Welex Jets. Call your nearest Welex Station for prompt service day or night.

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the OIL AND GAS JOURNAL

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In Brief . . .

1. BETTER GAS-INJECTION TECHNIQUE . . . When gas is injected into a reservoir at high pressures, an exchange of hydrocarbon components takes place between the gas and oil, resulting in a modification of the properties of both phases. The rich displacing gas may be either miscible or immiscible with the reservoir oil. If gas is miscible, phase boundary is removed, and most of the effects of capillarity are overcome. Result is that the displacement process becomes similar to that of oil by gasoline. Hence, nearly all the oil in the pore spaces contacted by the displacing phase is displaced.

•

2. BETTER PIPE-LINE CONTROL . . . Control system for the Platte Pipe Line consists of 44 stations between the Casper and Wood River terminals. The entire system is controlled by headquarters in Kansas City, except for V.H.F. circuits. These are controlled from three section stations. Of the 44 stations, 29 are unattended, containing primary and standby microwave repeater units, voltage regulators, service channel, and fault tone equipment.

•

3. EXPEDITING PROCESS UNIT CONSTRUCTION . . . Most construction schedules go astray due to starting construction too early. The question might better be phrased, "How late can construction start without losing full advantage of expected material deliveries?" When construction is started too soon, delayed arrival of major equipment necessitates curtailment of construction activity, and causes stoppage of field operations.

•

4. CONTRARY GASOLINE-PLANT OPERATION . . . Northern Natural Gas Co.'s Holcomb, Kans., gasoline plant is designed and operated to extract a minimum of natural gasoline from 185 million cubic feet per day of Hugoton field gas by gas refrigeration. This operation prevents hydrocarbon condensate difficulties common to transmission of unstripped high-pressure gas, yet maintains maximum heating value of the gas.

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5. MORE AROMATICS FROM PETROLEUM . . . The Arosorb process uses silica gel adsorption for removal of aromatics from mixtures containing paraffins and naphthenes. A feed stock is charged to a gel-packed column. Then a saturate liquid such as pentane is used to displace feed stripped of aromatics. The aromatics are then recovered from the gel by washing with an aromatic liquid. Advantage lies in process versatility, with high-purity product.

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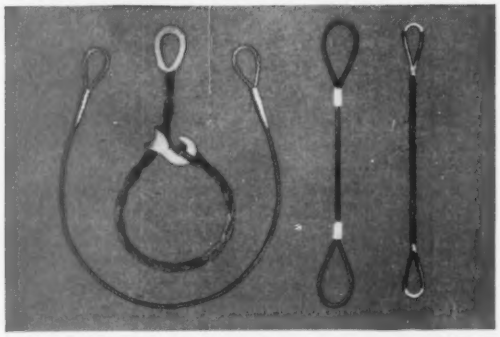

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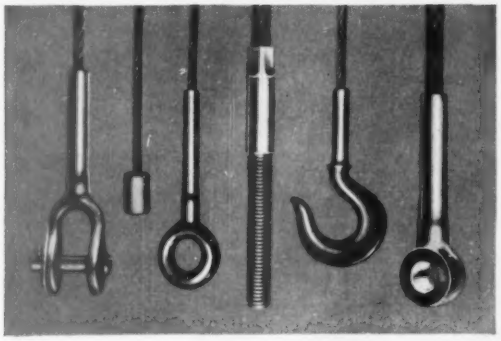

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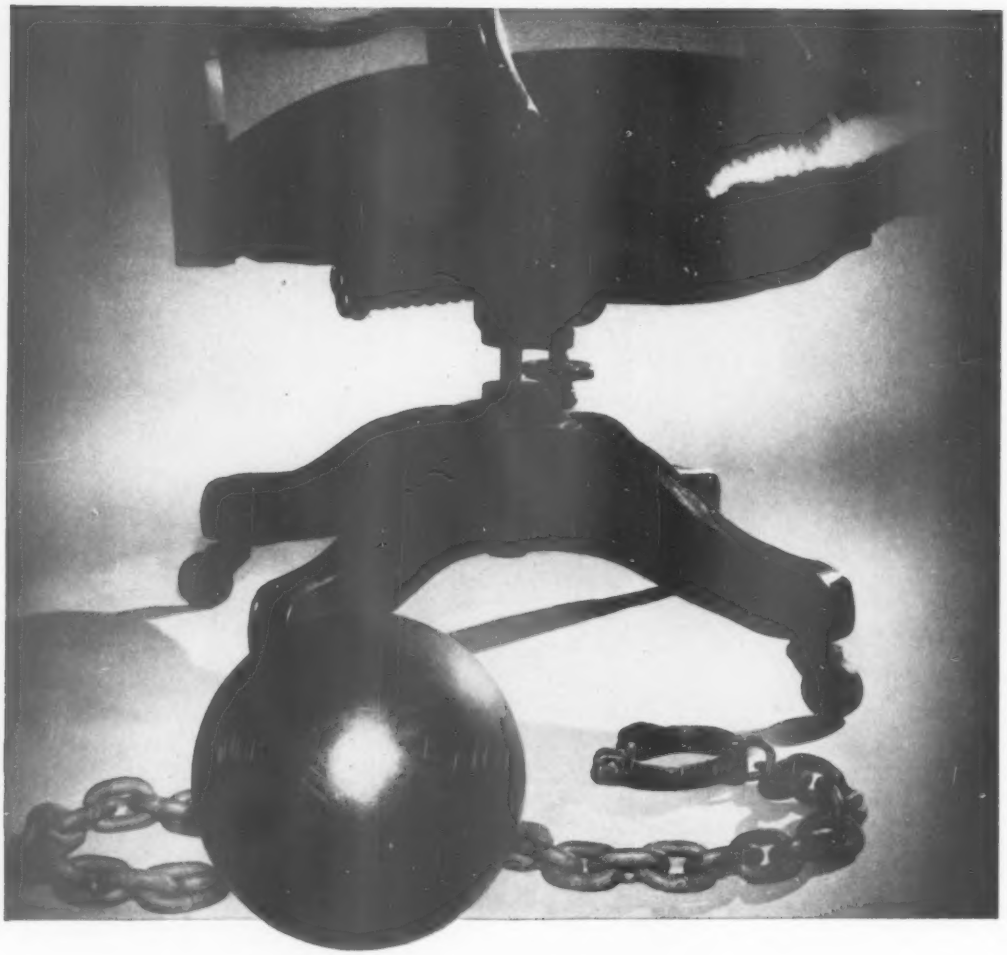

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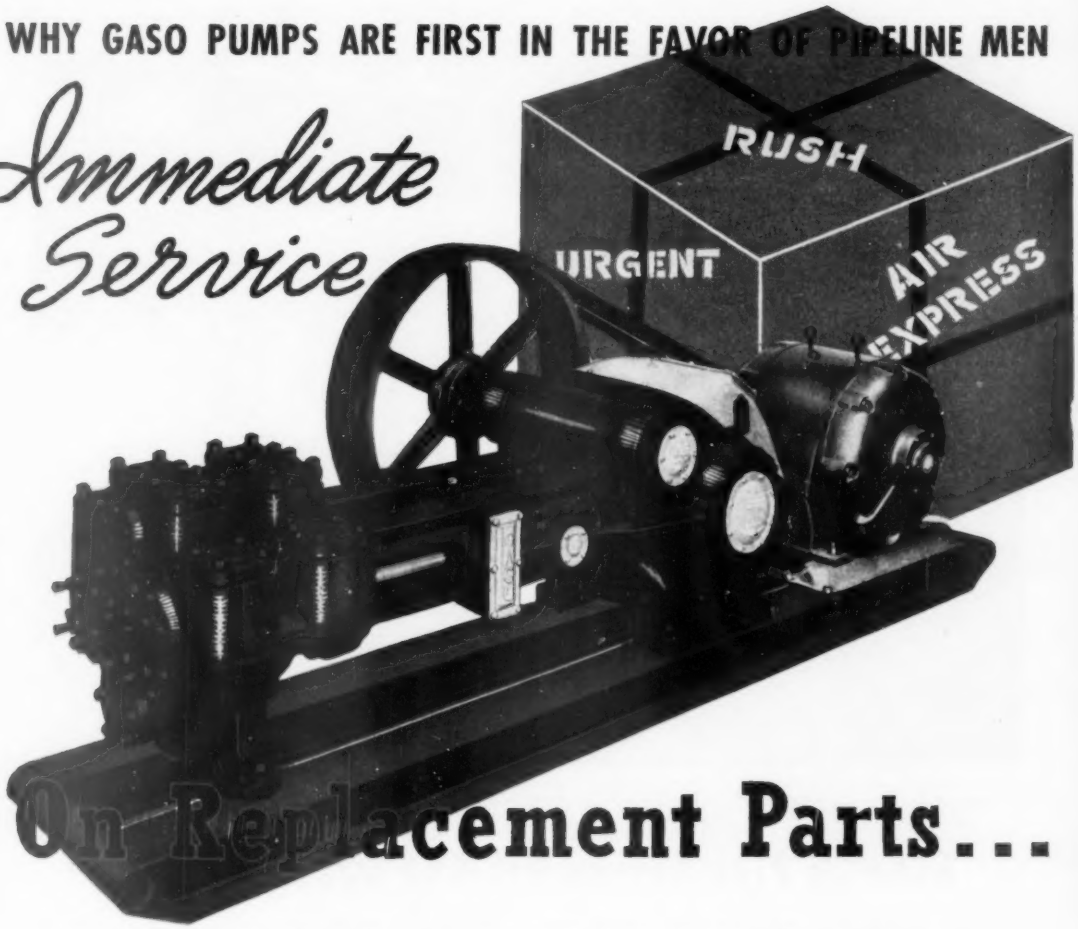

On Replacement Parts...

Let's face it—even Gaso Pumps may sometimes need a replacement part, especially when they have been operating long after the retirement age of ordinary pumps. But when it happens, Gaso users don't worry. They know that Gaso maintains stocks of parts for all standard models regardless of age, with a policy of immediate shipment by fastest possible route. May we send you a copy of our latest catalog?

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GASO PUMPS

for every oil industry need

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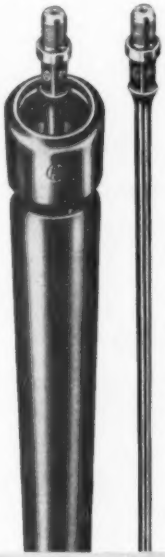

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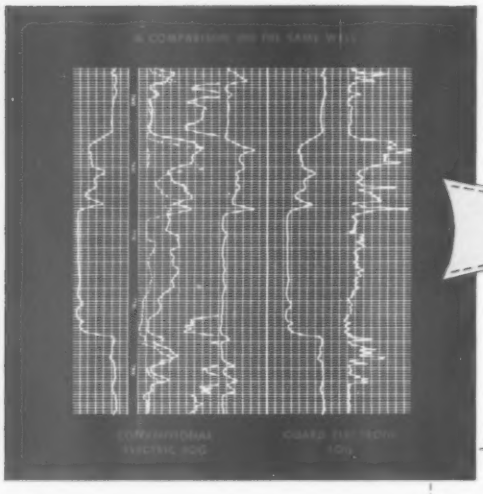

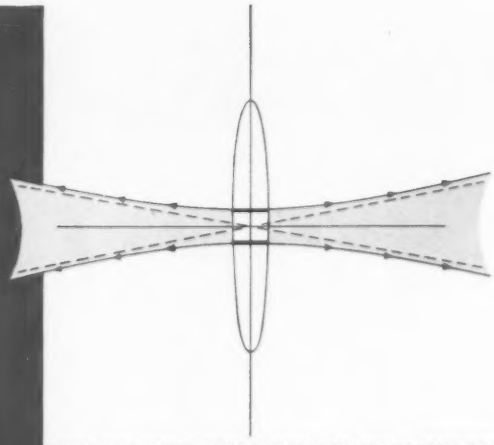

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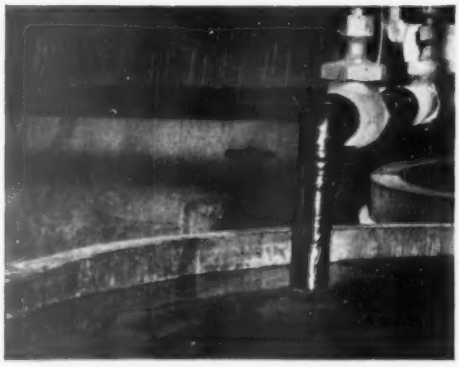
Field-tested Polyken Protective Coatings



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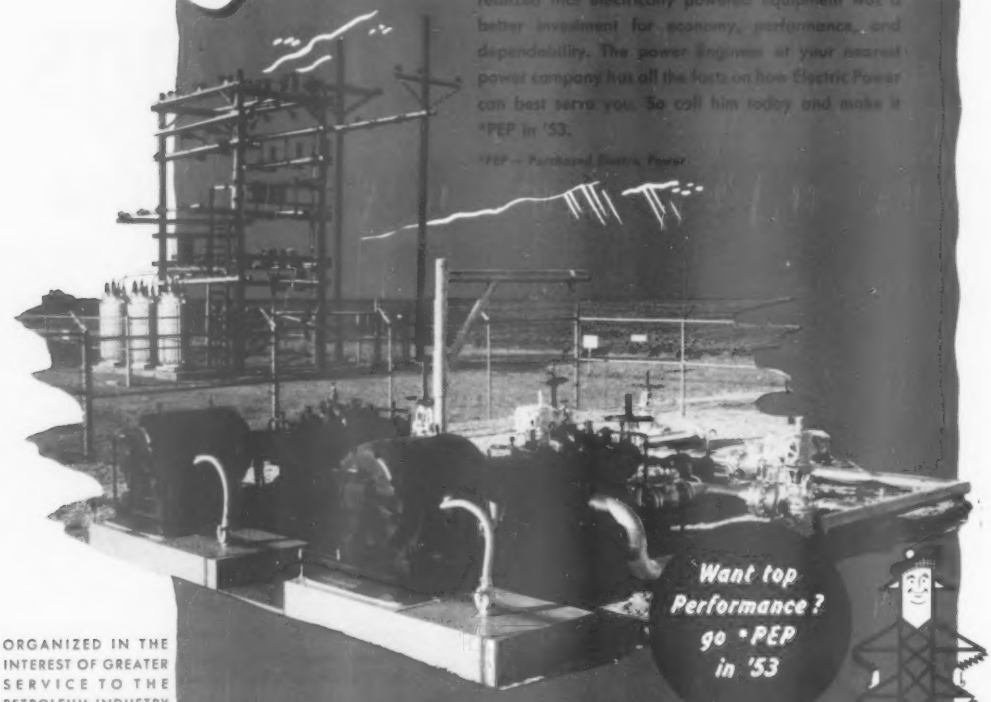

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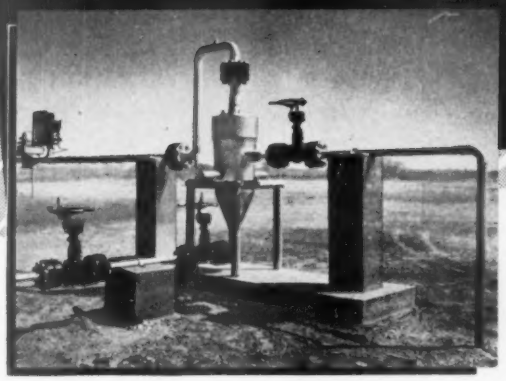

Installations of Aerotec Gas Scrubber at University, Block 31, Field, Crane County, Texas.

Cutaway section of Aerotec Gas Scrubber designed for high pressure applications.

New Proof of the practical, profitable advantages of Aerotec Dry Gas Scrubbers comes from the oil-producing industry. This backs up the long experience of natural gas companies with hundreds of units in daily use. These Aerotec Scrubbers, at wells and in pipelines, are cleaning foreign liquids and solids from natural gas with exceptionally high efficiency.

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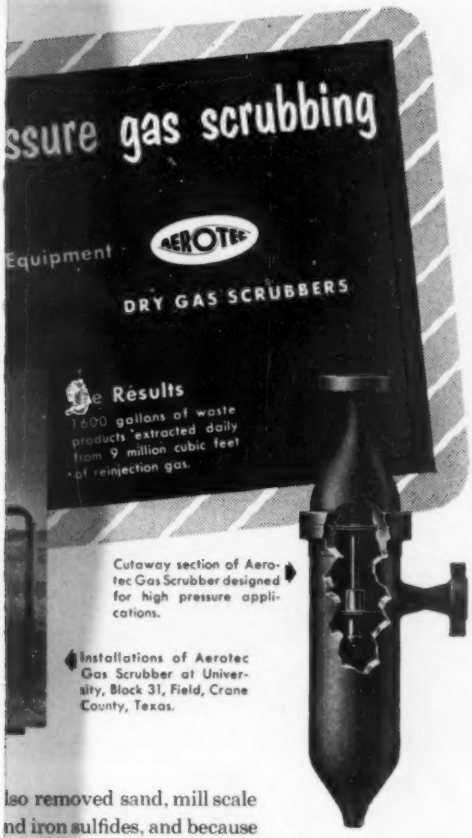
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1600 gallons of waste products extracted daily from 9 million cubic feet of reinjection gas.

Cutaway section of Aerotec Gas Scrubber designed for high pressure applications.

Installations of Aerotec Gas Scrubber at University, Block 31, Field, Crane County, Texas.

lso removed sand, mill scale
nd iron sulfides, and because
o fluids are used in the sepa-
ation process, no residue is carried over to
he gas.

Additional units are now being installed
efore new injection wells are put into operation.

Lightweight and compact, Aerotec Gas
crubbers are easy to install. Available in
tandard units up to 100,000,000 SCFD, they
an be manifolded to meet larger requirements.
For experienced engineering assistance in matching Aerotec Scrubbers to *your* specific need, or for catalog data on these units, call or write The Thermix Corporation.

University, Block 31, Field located in Crane County, Texas. The Aerotec Gas Scrubber removes components of lubricating oil from gas going to injection wells at 4,000 psi. It has

Project Engineers **THE THERMIX CORPORATION** Greenwich, Conn.

(Offices in 38 Principal Cities)

Canadian Affiliates: **T. C. CHOWN, Ltd., Montreal 25, Quebec; Toronto 5, Ontario**

Manufacturers

THE AEROTEC CORPORATION

GREENWICH, CONN.

It's a Fact

EVERY G-E 2-WAY RADIO CRYSTAL IS TESTED FOR DRIFT AND ACTIVITY FROM MINUS 22 TO 185 DEGREES FAHRENHEIT

THE all-important crystal supplied in your G-E 2-way radio equipment earns a performance diploma that more than qualifies it for the rugged service you demand in communications. Subjected to testing in the complete range from sub-zero to "hands off" temperatures, the crystal is painstakingly checked for frequency drift and activity. Crystals which drift more than *two-thousandths of one percent* are rejected! Those which fail G-E's stringent activity tests are also discarded.

G.E. starts crystal manufacturing process with x-ray selection of only the finest, faced Brazilian quartz and, in the final assembly, employs cleaning methods that are unique in the industry today. This somewhat lavish and exceptionally thorough preparation is justified by the key position crystals occupy as the *heart of 2-way radio and microwave equipment!*

The end result is a crystal which gives G-E equipment that rock-stable quality for which it is world famous. G-E crystals not only put your communications "on-the-beam" . . . they keep it there for years of service.

Production facilities for G-E crystals are geared to supply this superior product to manufacturers who demand quality crystals for other uses. Write for complete information: General Electric Co., Section 843-6, Electronics Park, Syracuse, N. Y.

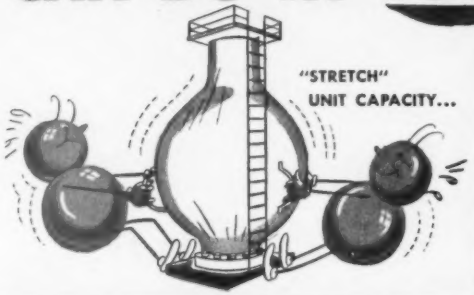
Call the nearest G-E office for data on this outstanding communications equipment—

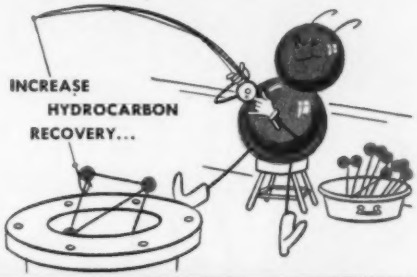
Dallas, Texas	Denver, Colorado	Washington, D. C.	Daytona Beach, Fla.	Cincinnati, Ohio
Houston, Texas	Kansas City, Mo.	Boston, Mass.	Detroit, Michigan	Chicago, Illinois
Tulsa, Okla.	New York, N. Y.	Atlanta, Georgia	Columbus, Ohio	Indianapolis, Ind.
New Orleans, La.	Syracuse, N. Y.	Charlotte, N. C.	Pittsburgh, Pa.	Minneapolis, Minn.
Los Angeles, Calif.	Philadelphia, Pa.	Montgomery, Ala.	Cleveland, Ohio	St. Louis, Mo.
	San Francisco, Calif.	Seattle, Wash.	Salt Lake City, Utah	

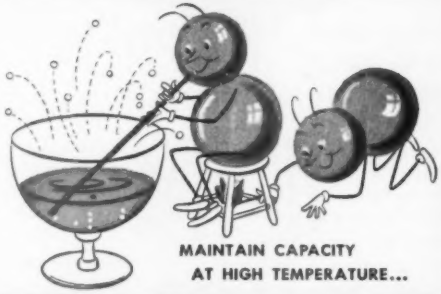
Follow the trend . . . replace with G.E.!

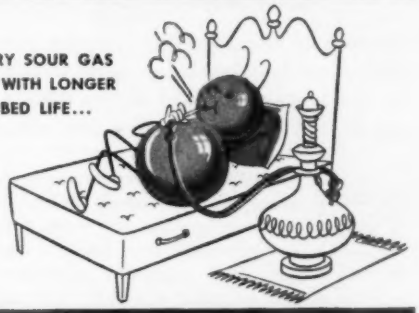
GENERAL ELECTRIC

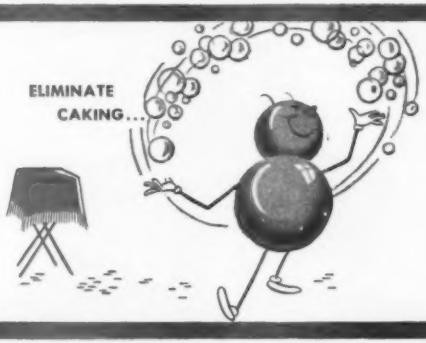
LOOK WHAT MR. SOVABEAD CAN DO IN YOUR DEHYDRATOR!

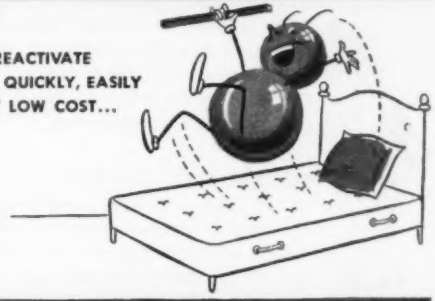












NOW... S/V Sovabead *is recommended* by most leading designers and manufacturers of solid-type natural gas dehydration units... *is used* by a majority of all operators of such units... *is performing satisfactorily* in hundreds of installations throughout the world!

Let S/V Sovabead improve *your* dehydration operations. Call your Socony-Vacuum Representative today!

SOCONY-VACUUM

Process Products

Process Products
SOCONY VACUUM

SOCONY-VACUUM OIL COMPANY, INC., and Affiliates:
MAGNOLIA PETROLEUM COMPANY, GENERAL PETROLEUM CORPORATION

This "Working Heart"

assures long life for your

LUNKENHEIMER VALVES

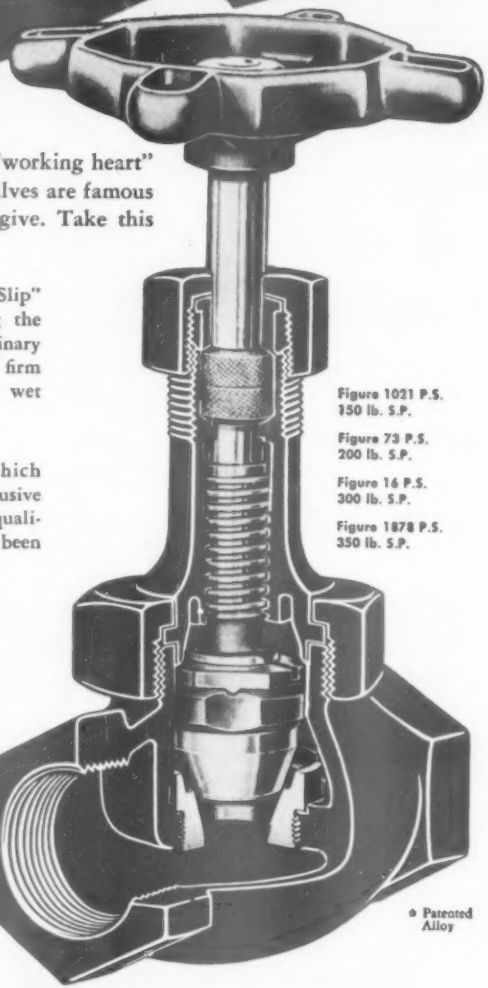


Figure 1021 P.S.
150 lb. S.P.

Figure 73 P.S.
200 lb. S.P.

Figure 16 P.S.
300 lb. S.P.

Figure 1878 P.S.
350 lb. S.P.

Handwheel, stem, and disc . . . these parts are the "working heart" that affects the life of every valve. Lunkenheimer valves are famous for the long, economical service these vital parts give. Take this 200 lb. S.P. "Renewo" Valve, for example:

HANDWHEEL is the new cool-operating "Non-Slip" design that eliminates leakage by enabling the operator to close the valve *tight* with ordinary hand pressure. Four rounded lugs provide a firm grip even when the operator's hands are wet and greasy.

STEM is made of famous "Stemalloy"*, which eliminates stem-thread failure. Amazing exclusive silicon-bronze alloy has exceptional wearing qualities. Millions are in use, and not one has ever been returned due to wear failure.

DISC AND SEAT — 500 BRINELL STAINLESS STEEL — for long, trouble-free service where erosive and corrosive conditions are present. Disc and seat are renewable and can be easily replaced with fullway type seat and disc.

Write for Circular 577, a new bulletin which gives you complete information on the "Renewo" line. And for the finest service on valves, see your Lunkenheimer distributor. The Lunkenheimer Company, Box 360F, Cincinnati 14, Ohio.

* Patented Alloy

BRONZE • IRON • STEEL

LUNKENHEIMER

THE ONE *Great* NAME IN VALVES

E-653-13

STRINGS OF STEEL

. . . metallurgists found a way

If you walk over the early oil fields like Troutman and Bear Creek and Titusville, you'll find the original wooden sucker rods lying among rotting bull-wheels and termite-pulverized drilling platforms. The wooden rods were mighty useful in their day, but it was a very short span of years until they were entirely inadequate throughout most of the oil country.

Meanwhile, though, metallurgists had been at work. To make mechanical pumping of deep wells economically feasible, these engineers developed and perfected the modern strings of steel—able to stand up under high tensile stresses, impact loading, and the corrosive action of well fluids.

Few of those who work with sucker rods realize the extent of the metallurgical laboratory research involved in perfecting these thin strings, thousands of feet in length and weighing many tons. Yet, at National Supply, there's a continuing program of research and development on sucker rods which is carried out both in field and laboratory. It's an important part of the overall development program which has produced such well-known oilfield equipment as National's 160 Rig, the Ideal Plunger Lift, Spangweld Drill Pipe, Superior Drilling Engines.

At the International Petroleum Exposition in Tulsa in May, you'll see more evidence of the effectiveness of National's development program— ***everything that's new in National Blue.***

THE NATIONAL SUPPLY COMPANY

Pittsburgh 30, Pennsylvania

Gas-engine driven pumping unit of the type used on deep wells

NATIONAL PUMPING

efficient pumping equipment for every purpose

D-15 PUMPING UNIT

Pumping Unit used for water well service on drilling operation

The complete line of National Pumping Units includes sizes and types for effective recovery from any reservoir which can be produced by rod-pumping. Thus, the problem of applying equipment for every requirement from completion to depletion is simplified by standardizing on National Pumping Units.

For profitable pumping at any depth there are 60 standard combinations of National Pumping Units with API walking beam ratings from 3,200 lbs. to 32,400 lbs. They were designed by engineers with long field experience in the application of all types of production equipment, and new units are constantly being added to the line to meet expanding industry requirements.

National Pumping Units have many outstanding features such as—

- infinitely variable adjustments of counterweights for maximum operating efficiency
- needle type saddle bearings with single-point pressure lubrication specifically designed for oscillating service
- main bases and base extensions constructed to accommodate any type of prime mover and any method of pumping unit installation

For complete information on all sizes and capacities consult the composite catalogs or write for descriptive bulletins.

THE NATIONAL SUPPLY COMPANY

PITTSBURGH 30, PENNSYLVANIA

DIVISION OFFICES: Casper, Ft. Worth, Houston, Pittsburgh, Tulsa, Torrance

CANADA: The National Supply Company, Ltd., 2nd Floor F. W. Clark Building, 709 Eighth Avenue, West, Calgary, Alberta, Canada

EXPORT: 600 Fifth Avenue, New York 20, N.Y., U.S.A.; River Plate House, 12 South Place, London E.C. 2

NATIONAL BLUE PRODUCTS

NATIONAL OIL FIELD MACHINERY AND EQUIPMENT

SPANG STEEL PIPE

SUPERIOR & ATLAS ENGINES

for trouble-free production

SPECIFY NATIONAL

Rod-Pumping Equipment

For little or no corrosion Grade 40

For moderate corrosion Grade 81

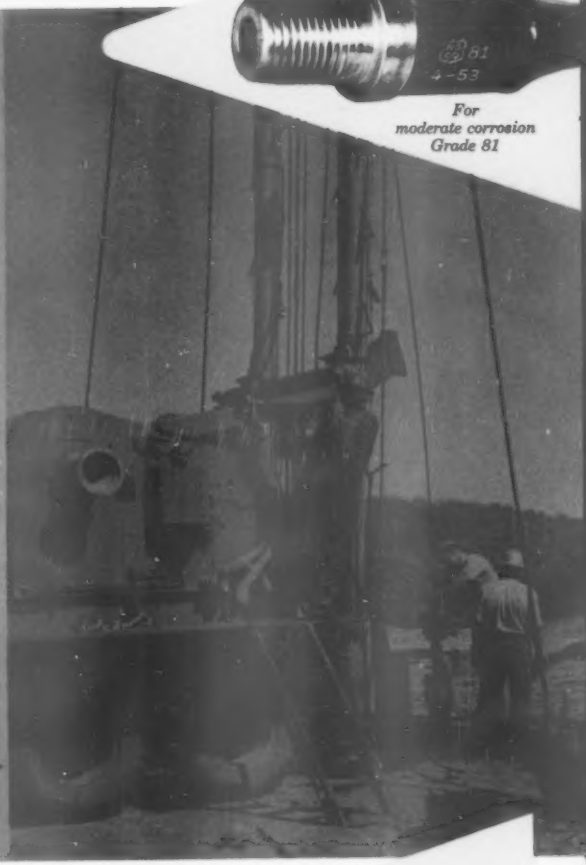
- ★ SUCKER RODS
- ★ SUCKER ROD COUPLINGS
- ★ API PONY RODS
- ★ POLISHED RODS
- ★ API PULL RODS

National Supply Stores stock a complete line of rod-pumping equipment and accessories—built to work together and designed for maximum effective production under widely variable pumping conditions.

As with all National production equipment, National Sucker Rods and rod-pumping accessories are studied constantly under field operating conditions and are subjected to frequent metallurgical laboratory tests in order to maintain the high performance standards you can expect in all National Supply equipment.

When you specify National Sucker Rods and accessories you can be sure of your source of supply at the nearby National Store, and sure, too, of the trouble-free production you'll always get with National equipment.

Truck-mounted National T-12 Well-Servicing Hoist



NATIONAL BLUE PRODUCTS

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For sulphide corrosion Grade 92

NATIONAL OIL FIELD MACHINERY AND EQUIPMENT • SPANG STEEL PIPE • SUPERIOR & ATLAS ENGINES

HELP NEW Cracking Methods

ALLIS-CHALMERS
Centrifugal Blowers

LEFT: Catalyst lift air blower supplies air at 13,320 cfm, 4.25 psig to raise regenerated catalyst to reactor. Kiln combustion air blower is seen to the rear.

ABOVE: Carbon is burned off the catalyst while air is supplied at 34,400 cfm, 3.5 psig by this kiln combustion air centrifugal blower.

AS CRACKING METHODS IMPROVE, more centrifugal blowers are being employed. The Allis-Chalmers single stage blowers seen here are essential to the three new Thermofor Catalytic Cracking units installed by the Magnolia Petroleum Co. at Beaumont, Texas.

A total of six turbine-driven A-C single stage blowers provide kiln combustion and catalyst lift air in the blower room of the new catalytic structure.

The high efficiency impellers are of special totally enclosed, backward flow design. This covered design makes the impellers independent of tolerance variations; the backward flow design gives good pressure, volume and horsepower characteristics.

High strength and long life is assured by all-welded, alloy steel impeller construction and pressure lubricated sleeve and thrust bearings. Cast iron casing increases rigidity and decreases noise level.

For this kind of specialized design . . . or for standard high quality, thoroughly tested air and gas handling equipment . . . call your nearest A-C office or write to Allis-Chalmers, Milwaukee 1, Wis.

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ALLIS-CHALMERS A-C

Power, Electrical, Processing Equipment for Petroleum Industry

TURBINE-GENERATORS | BLOWERS and COMPRESSORS | TRANS-FORMERS | UNIT SUBSTATIONS | MOTORS—*TEXROPE* DRIVES-CONTROL | CENTRIFUGAL PUMPS

it's a faster, easier job with Claymont Welded Steel Pipe

Ease of bending and welding has won outstanding preference for Claymont Welded Steel Pipe on the longest and toughest pipe line jobs.

Every length of Claymont Pipe is made from high tensile steel plate produced in our own plant and carefully controlled through every phase of fabrication starting with the open hearth.

Claymont Pipe bends readily, field-welds fast and uniformly; fits accurately because end bevelling is precision-machined on the most modern end-facing equipment. Uniform size, straightness, roundness and ability to meet the most rigid specifications is assured through hydraulic expansion and exacting hydrostatic testing.

We can supply you with Claymont Welded Steel Pipe in lengths of 40 feet and in overall diameters from 22 inches through 36 inches. Special lengths and diameters can be provided if required. For complete information write or call Claymont Steel Products Department, Wickwire Spencer Steel Division, Claymont, Delaware.

Stainless-Clad Steel Plates . . . Flanged and Dished Heads . . . Carbon and Alloy Steel Plates

THE COLORADO FUEL AND IRON CORPORATION—Denver, Colorado
THE CALIFORNIA WIRE CLOTH CORPORATION—Oakland, California
WICKWIRE SPENCER STEEL DIVISION—Atlanta • Boston • Buffalo • Chicago • Detroit • New York • Philadelphia
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CLAYMONT
WELDED STEEL PIPE
PRODUCT OF WICKWIRE SPENCER STEEL DIVISION
THE COLORADO FUEL AND IRON CORPORATION
CF&I

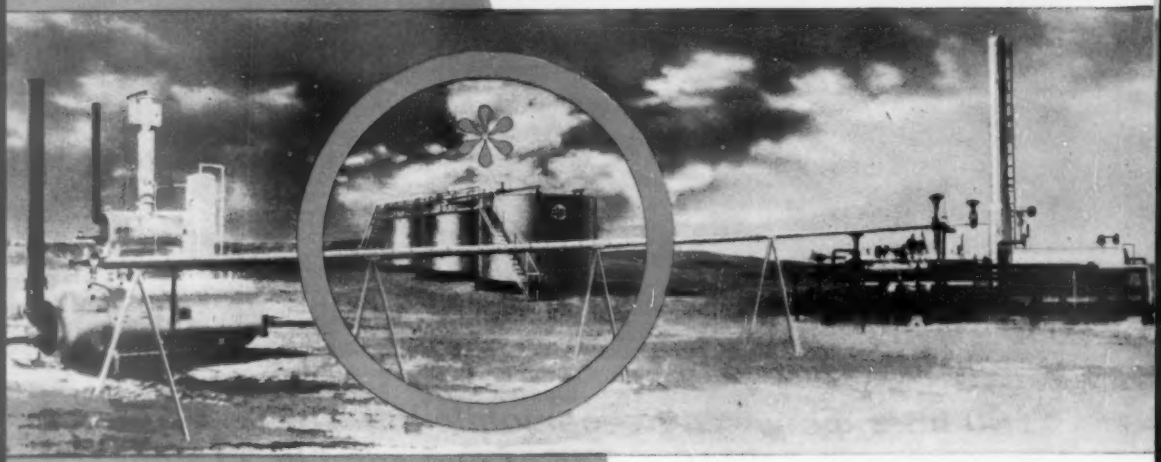
1419

BS&B Glycol Injection System

OF LOW TEMPERATURE SEPARATION

with STABILIZER**

51% greater recovery Over Old Two Stage Separation" says one operator!



A typical installation — BS&B Glycol Injection System of Low Temperature Separation with Stabilizer.

From a case history report (name of company on request) we find how a "team" of BS&B equipment increased and kept profitable recovery. The combination of the BS&B Glycol Injection Unit and BS&B Stabilizer not only recovers more from this company's condensate gas wells in South Texas but holds more of the condensate. They report average increased recovery is 57%, or equivalent to an increase of 11.28 barrels per MMSCF of sales gas—or in terms of money $161.06.

Put BS&B "Inven-gineering" (inventive talent and engineering experience) to work for you. Call in your nearest BS&B representative now—to help you get the equipment best fitted to produce the top profit from your leases. Or, write us—today.

** Patented and patents pending.

More condensate to the stock tank and kept there... thanks to BS&B Low Temperature Separation

EFFICIENCY BS&B RELIABILITY OUR 60TH YEAR

BLACK, SIVALLS & BRYSON, INC.

Oil & Gas Equipment Division, Dept. 1-A4

2131 Westwood Blvd. Oklahoma City, Oklahoma

See Our Exhibit OIL SHOW TULSA MAY 14-23

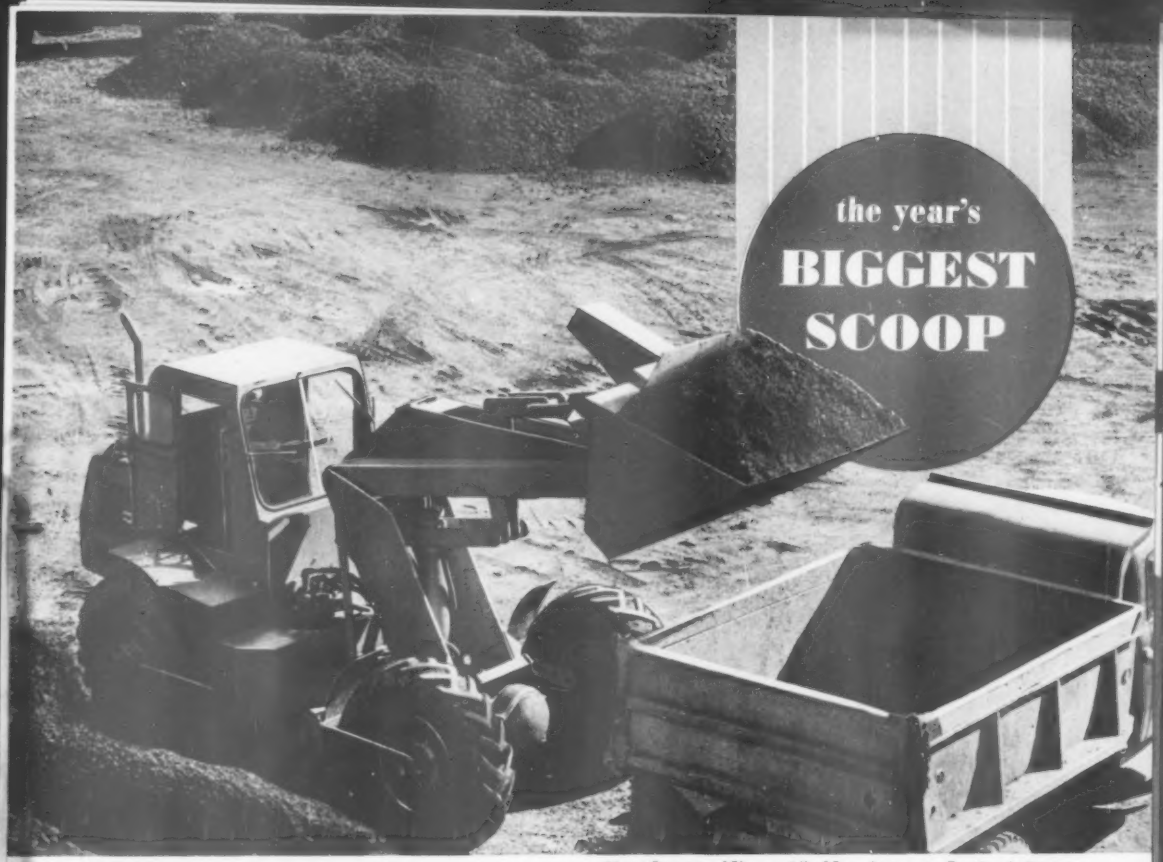


Photo Courtesy Mixermobile Manufacturers, Portland, Oregon

180 horsepowered Scoopmobile loads 4319 yards of wet sand in 31 hours!

No stranger to hard work, this loader. Each time it bends down, a hydraulically operated loading bucket picks up, carries and loads as much as two cubic yards of dirt, rock or sand. Four-wheel planetary gear drive and four-wheel power steering are combined for plenty of power, amazing speed and maneuverability. Five-speed transmission enables top performance under any conditions of terrain.

Like others, this manufacturer powers with Chrysler because he *knows* every Chrysler Engine is engineered for long-lived, top-profit performance. He selected the husky Model 20 Chrysler V-8 Industrial Engine. Result: *more* work in *less* time.

Chrysler can equip its 180 horsepower Model 20, or any of its Industrial Engines, to meet special requirements. For example, Chrysler can supply engines with propane or natural-gas burning carburetor, gýrol Fluid Coupling or torque converter.

Chrysler Industrial Power is not expensive. Production-line methods adapted to specialized engine building provide a custom-built engine at mass-production prices. See a Chrysler Industrial Engine Dealer or write: ***Department 154, Industrial Engine Division, Chrysler Corporation, Trenton, Michigan.***

CHRYSLER
Industrial Engines

HORSEPOWER WITH A PEDIGREE

GLOBE

specialization gives you
"Tops in Quality"

ALLOY STEEL TUBES

SEAMLESS — MECHANICAL — PRESSURE — CORROSION RESISTANT

TYPICAL ANALYSES:

Carbon	5 Chrome ½ Moly
Carbon ½ Moly	7 Chrome ½ Moly
½ Chrome ½ Moly	8 Chrome ½ Moly
1 Chrome ½ Moly	8 Chrome 1 Moly
1¼ Chrome ½ Moly	9 Chrome 1 Moly
2 Chrome ½ Moly	3% Nickel 7% Nickel
2¼ Chrome 1 Moly	5% Nickel 9% Nickel

AISI Types: 304-321-347-316-309-310-405-410-430-443-446

Analyses to meet conditions where heat, corrosion, pressure and structural strength are involved.

SIZE RANGE — WALL THICKNESS:

½ to 6 inches O.D. — wall thickness .035 to 1,000 inch.

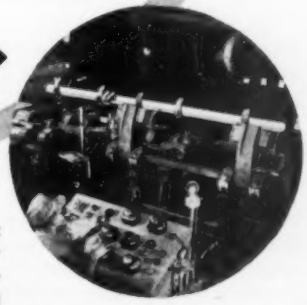
TYPICAL APPLICATIONS:

Pressure tubes — Superheater tubes — Condenser tubes — Still tubes — Evaporator tubes — Barrel tubes — Oil-well Pump Barrels — Mechanical tubes — Aircraft tubes — Propeller tubes — Rollers for Transmission Chains.

Globe engineers gladly give you the benefit of specialized knowledge of stainless steel tubing in a wide range of services and applications — to improve your product — to cut costs.

TO BE SURE . . . SPECIFY GLOBE

The heating, piercing, rolling of seamless tubes is controlled at every step for uniformity, close tolerance.



WHEN you specify Globe, you get uniform high quality alloy steel tubes, the product of highly developed production facilities and specialized quality controls and methods. All Globe tubes are thoroughly inspected and closely held within tolerance specifications. Write for the Globe general catalog.

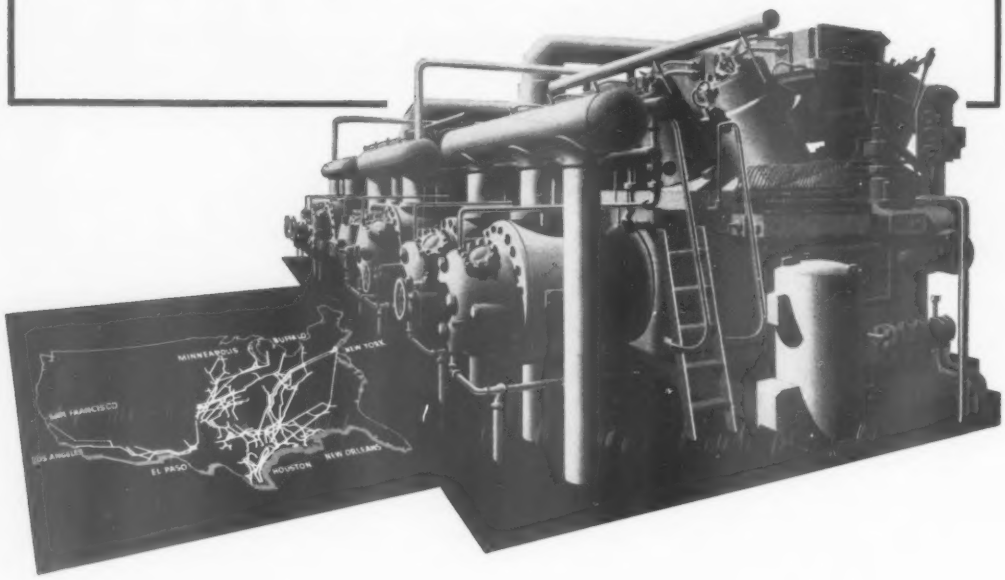
GLOBE STEEL TUBES CO.

Milwaukee 46, Wisconsin Chicago • Cleveland • Philadelphia • St. Louis • New York Detroit • Denver • Houston • San Francisco • Glendale, Cal.

Producers of Globe seamless stainless steel tubes — Gloweld stainless steel tubes — alloy — carbon — seamless steel tubes — Globeiron (high purity ingot iron) seamless tubes — Globe Welding Fittings.

GULF SECURITY OIL

provides better lubrication
for pipe line compressor units,
helps prevent operating troubles



Here's the lubricant you can depend on to help keep your pumping stations operating smoothly and continuously—Gulf Security Oil. It provides effective protection for cylinders and bearings in both engines and compressors.

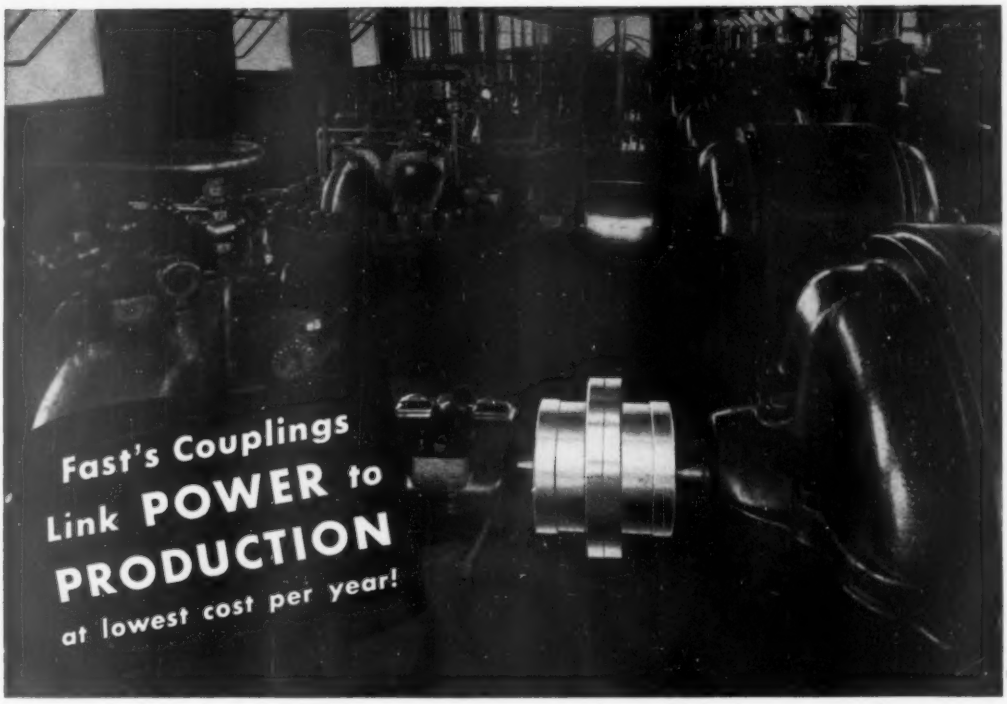
Because of its excellent resistance to oxidation, Gulf Security Oil stands up for many hundreds of hours without any appreciable change in its original properties. After years of operation with this quality lubricant, equipment shows remarkable freedom from cylinder wear and a minimum of carbon deposits on valves and rings. And because oil control rings are kept clean, oil consumption is remarkably low.

Operators of the many units lubricated with Gulf Security Oil report that this quality lubricant helps them get more operating hours between overhauls, and avoid unscheduled shutdowns.

For additional information on Gulf Security Oil and for the services of a Gulf Sales Engineer, get in touch with your nearest Gulf office today. Write, wire, or phone.

Gulf Oil Corporation · Gulf Refining Company,
Pittsburgh 30, Pennsylvania.

GULF INDUSTRIAL LUBRICATION



Over half a million FAST'S Couplings now in use!

THROUGHOUT industry, Fast's are rated the most dependable couplings on the market . . . to the tune of over half a million now in service! Year in, year out, they continue to *outlast the equipment they connect* . . . save time, maintenance and money by eliminating costly coupling failures.

Actual cases on record show many Fast's Couplings have been in operation for 25 and 30 years without trouble. And every major producer of high-speed equipment now uses Fast's!

Solve your coupling worries! Write today for full details on Fast's Couplings and Koppers Engineering Service to: KOPPERS COMPANY, INC., *Fast's Coupling Dept.*, 284 Scott St., Baltimore 3, Maryland.

Here's How FAST'S Save You Money

Free Service—Koppers free engineering service assures you the right coupling for the job.

Rugged Construction—Fast's still maintains its original design, without basic change or sacrifice in size or materials. Result: freedom from expensive coupling failures.

Lowest Cost per Year—Fast's Couplings usually outlast equipment they connect. Their cost may be spread over many years!

KOPPERS

FAST'S
THE ORIGINAL
GEAR-TYPE
Couplings

INDUSTRY'S STANDARD FOR 32 YEARS

KOPPERS COMPANY, INC., *Fast's Coupling Dept.*
284 Scott St., Baltimore 3, Md.

Gentlemen: Send me Fast's Catalog which gives detailed descriptions, engineering drawings, capacity tables and photographs.

Name _____

Company _____

Address _____

City _____ *Zone* _____ *State* _____

NOW

for your greater convenience

WOLVERINE BRINGS YOU "U-BEND" CONDENSER TUBES PACKAGED IN EXPENDABLE PALLETS . . .

The use of "U-Bend" — plain or finned — tube eliminates one tube sheet, rolling-in operations are reduced by one-half and floating head problems are eliminated.

This form of packaging saves you much time. Often a whole complement of tubes for condenser installation can be shipped in one pallet. All the tubes can be fed directly from the pallet type container into the condenser unit or the heat exchanger. Tube unloading, inspection, installation and handling costs are thus materially reduced.

Each pallet is designed and constructed to suit individual customer's needs and to withstand the abuses encountered in transit.

You'll save considerable time by keeping these unit pallets at hand as stand-bys. In this condensed package they occupy comparatively small storage space and can easily be stacked.

WOLVERINE TUBE DIVISION
of CALUMET & HECLA, INC.
Manufacturers of Tubing Exclusively
1459 CENTRAL AVENUE • DETROIT 9, MICHIGAN
ESTABLISHED 1916
Plants in Detroit, Mich. & Decatur, Ala. *Sales offices in Principal Cities*

Export Department, 13 E. 40th St., New York 16, N. Y.

SPECIFY

Wolverine Electric Welded Steel Tube

—the dependable tube made by tube specialists

One of the best decisions you could make when ready to buy steel tubing for your condenser, heat exchanger and boiler installations is to specify Wolverine Electric Welded Steel Tube.

Here is a tube that is made by specialists—by skilled men who are devoting their entire working time to the development and production of tube—at it since 1916.

By consulting our Customer Engineering Service you can avail yourself of a vast background of tube experience that can help you with the selection of the right tube to meet your particular operating conditions. We invite your correspondence or call.

In all diameters from ¼" to 3" O.D. in the following analyses: SAE 1010, SAE 1015, SAE 1020, SAE 1025, and SAE 1030.

ESTABLISHED 1916

WOLVERINE TUBE DIVISION
of CALUMET & HECLA, INC.

Manufacturers of Tubing Exclusively

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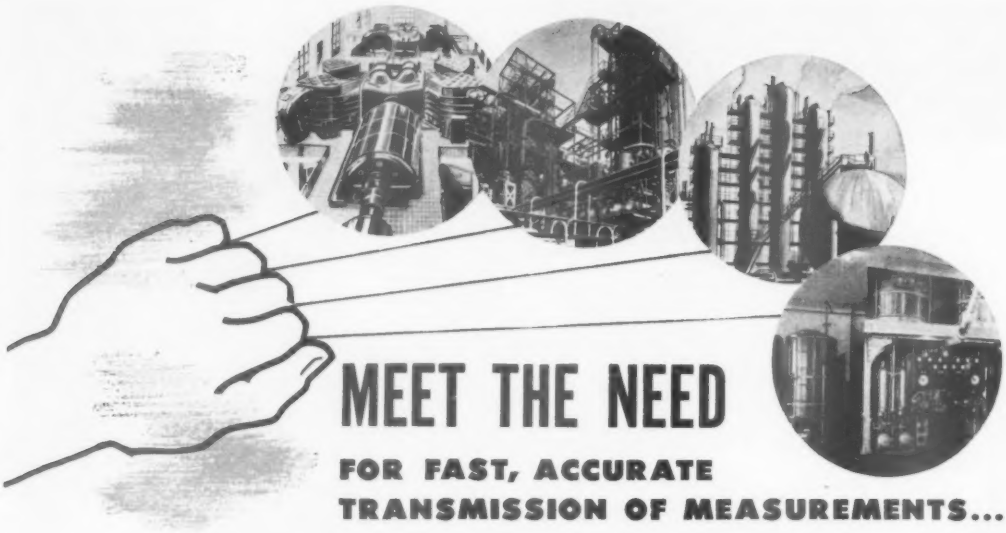
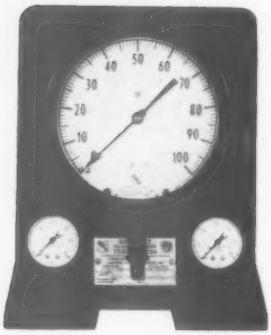


MEET THE NEED

FOR FAST, ACCURATE TRANSMISSION OF MEASUREMENTS...

ASHCROFT PNEUMATIC TRANSMITTERS



ASHCROFT PNEUMATIC PRESSURE TRANSMITTER with two 2-inch gauges, one reading "Air Supply," the other "Transmitted Air." Other types available for temperature, differential pressure, flow and liquid level.

Measurements of pressure, temperature, differential pressure, flow and liquid level must be transmitted quickly, accurately and safely to assure the efficiency required by modern process engineering. Ashcroft Pneumatic Transmitters more than fill those requirements—contribute greatly to the perfect performance demanded of vital instrumentation at one or more remote control centers.

Ashcroft Transmitters are ideal for all process industries and power stations—wherever it is desirable to confine high pressures or inflammable, poisonous or corrosive liquids and gases close to their source. They are also highly suitable where fire or explosion hazards make electrical wiring objectionable, or where the existing source of compressed air can easily be used.

Built into Ashcroft Transmitters are many design advantages proved through years of experience in manufacturing pressure gauges. They operate on low-pressure air—transmit proportionate air pressures to one or more pressure-actuated receiving indicators, recorders and controllers up to 1000 feet away with accuracy within ½ of 1%. Expensive, high-pressure lines and fittings, with all their leakage and maintenance problems, are avoided.

Write for details about Ashcroft Pneumatic Transmitters. Or ask your nearby Instrument Distributor for complete data on all types.

YOUR INSTRUMENT DISTRIBUTOR carries Manning, Maxwell & Moore products because he wants to be sure you get the best in quality, performance and economy. You can depend on him for prompt service.

ASHCROFT GAUGES

A product of **MANNING, MAXWELL & MOORE, INC.** STRATFORD, CONNECTICUT

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SAVES HUNDREDS OF DOLLARS ON A SINGLE WELL... Corexit has eliminated up to 75% of the shut-downs and equipment failures due to tubing and sucker rod corrosion in sour crude wells.

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Corexit gradually builds up a protective coating inside the tubing and on sucker rods to prevent corrosion. Tests show that where corrosion has already started, Corexit is effective in checking further corrosion.

COMBATS HYDROGEN EMBRITTLEMENT

Many sucker rod failures are caused by hydrogen embrittlement. Corexit coats corroded spots on old sucker rods and prevents the entrance of additional atomic hydrogen. On new sucker rods, Corexit combats hydrogen embrittlement. Write for information today. Corexit can save you money.

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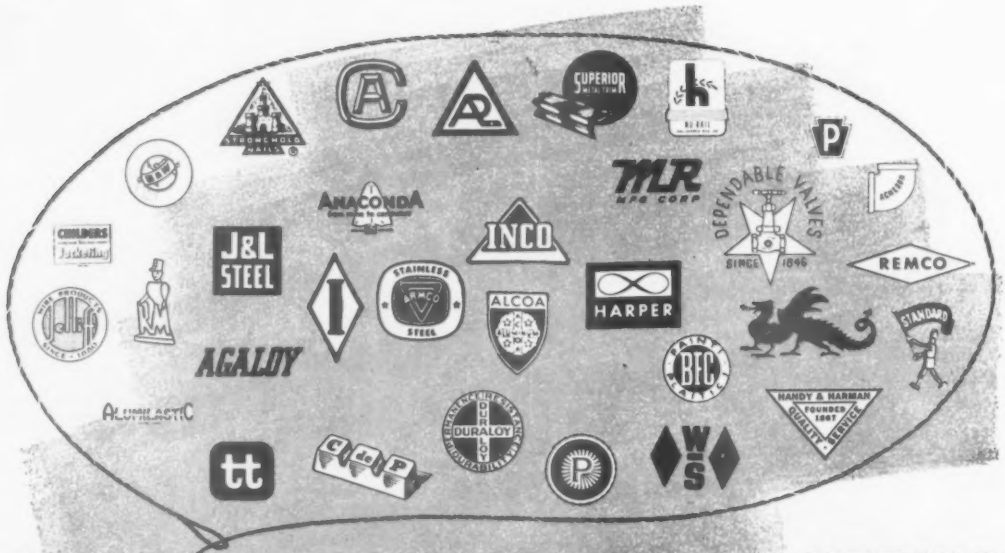

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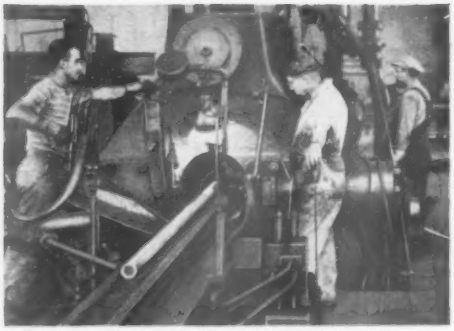

Extrusion Process—the first step in producing tubes.

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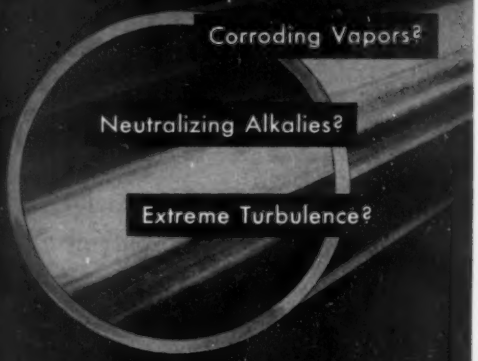
PROBLEMS IN *Exchangers... Evaporators?*



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Phelps Dodge Heat Exchanger Tubes are available in following alloy combinations:

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Admiralty (Blackskin)	Cupro-Nickel, 20%
Aluminum Brass	Cupro-Nickel, 10%
Aluminum Bronze	Superloy
Red Brass	Copper (Deoxidized and Arsenical)

PHELPS DODGE COPPER PRODUCTS CORPORATION

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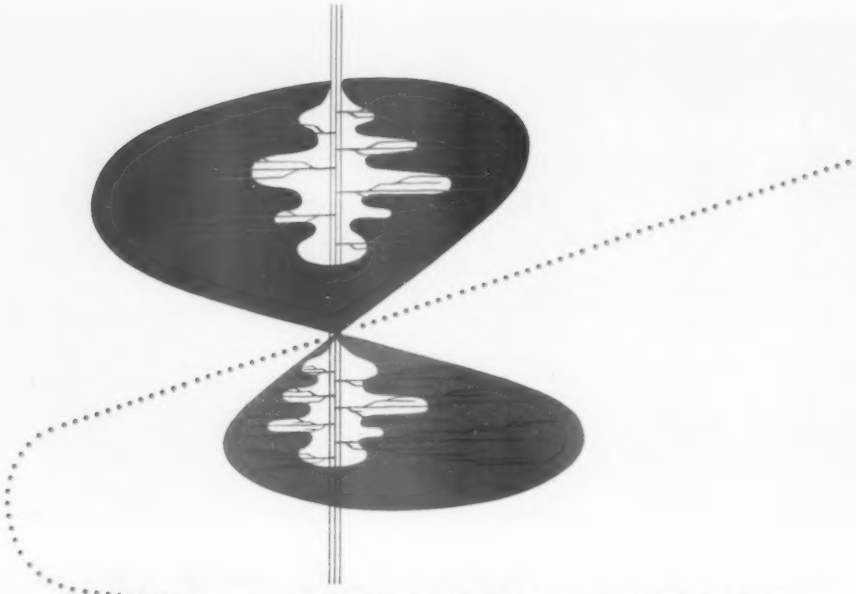

DOUBLE ACTION COMPOUND INCREASES PERMEABILITY!

HALLIBURTON'S MCA

Halliburton's unique Mud Cleanout Agent is reversing the old view that plugged off channels must be abandoned. It is doing this by breaking through mudded pay zone channels and effectively increasing permeability.

MCA, a precise compound of Halliburton's Morflo and hydrochloric acid, performs an outstanding double action job on plugged off channels. *This exclusive chemical blend not only shrinks clay, but actually disperses particles that impede flow.* Even bentonite shrinks before MCA as the hydrogen from the hydrochloric acid replaces sodium on the bentonite in the formation. And MCA does not permit the bentonite to rehydrate even when the formation is filled with fresh water.

Results have been highly satisfactory. One non-producing well flowed 100 barrels a day one month after treatment with MCA. A gas well estimated at 6.4 M cubic feet climbed to 20 M when treated. Other oil wells revealed gains of 60 to 168 barrels, and 200 to 360 barrels. And one well treated with Halliburton's MCA increased its flow from 360 to 1,200 barrels.

Average wells do not demand great amounts of MCA. Usual job procedure requires about 500 gallons initially, although a second or third treatment may be recommended when mud has penetrated the formation to extreme depths.

Additional important benefits of MCA concern its use in connection with squeeze cementing. Operators have found that MCA can be greatly beneficial when used prior to squeeze cementing because its cleaning and dispersing ability permits securing a better bond to the formation.

Your nearby Halliburton representative can give you fingertip facts on how this double action compound can help you increase the permeability of your pay zones. Or contact Halliburton Oil Well Cementing Company, Duncan, Oklahoma.

HALLIBURTON

YEARS AHEAD IN PRODUCTION IMPROVEMENT TECHNIQUES

PETROLEUM CHEMICALS DIVISION
NEWS

April ★ One of a Series of Interest to the Petroleum Industry ★ 1953

Du Pont's Broad Experience Helps Solve Varied Customer Problems

To a casual observer, the use of farm chemicals and that of petroleum additives would seem industries apart.

Recently, however, one of our TEL customers mentioned a serious refinery problem to his Petroleum Chemicals representative. This customer was concerned about the cost of controlling weeds and grasses around a refinery tank farm. Each year it amounted to several thousands of dollars. The reason for this exorbitant cost was that conventional weed killers had little or no effect.

The Petroleum Chemicals representative discussed the problem with Du Pont's Grasselli Chemicals Department and found that a new experimental Du Pont weed killer would do the job—at a fraction of the former cost.

The breadth of experience available in Du Pont is equalled by few other companies. Whether your problem be color conditioning, the use of explosives, stream pollution, or one of countless others, there is usually someone at Du Pont in a position to help you.

PETROLEUM LABORATORY STUDIES CARBURETOR MIXTURE PROBLEMS

A trend toward leaner carburetor mixtures is presenting a growing problem to refiners. This is especially significant since too lean a mixture can cause knock which is likely to be blamed on fuel quality.

To help refiners overcome this problem, the Du Pont Petroleum Laboratory is now studying the effect of lean mixtures on octane requirement. And to facilitate this program, several cars in the Du Pont fuel test fleet have been specially equipped for studying engine performance under varying fuel-air mixtures.

Several different types of fuels have been tested so far and it has been found that some are more sensitive than others to knocking tendencies at lean mixture settings.

This work is part of a broader Du Pont research program investigating factors contributing to knocking tendency which are not directly related to fuel quality . . . such as humidity, altitude and temperature variations.

Refiners who are encountering this type of problem are invited to consult with the Petroleum Chemicals Division's automotive specialists.

"INFORMATION PLEASE?"

Du Pont Petroleum Laboratory offers its research findings to oil companies

As a result of the research work at the Du Pont Petroleum Laboratory, much information useful to the oil industry has been accumulated.

Based on this, a number of papers and discussions have been published over a period of years by Du Pont engineers and researchers. All of this material is available to the industry through Du Pont and the various societies at whose meetings the papers are originally presented.

JAMES A. GORRY, office manager of the Petroleum Chemicals Division Wilmington office, displays several of the Du Pont papers which have proved helpful to petroleum engineers.

The literature covers a broad range of subjects of interest to oil company technical groups. It includes comprehensive and detailed information on the laboratory's studies of fuel stability, combustion chamber reactions and how engine deposits affect octane requirement.

OTHER TOPICS

There are also considerable data on the effects of sulfur compounds on octane numbers and combustion of leaded fuels. Included too, are discussions on exhaust valve performance, antiknock antagonists and temperature effects on octane requirement.

Several of the papers have received recognition as outstanding contributions to the knowledge of fuel and engine performance. For example, "Possible Mechanisms by which Combustion Chamber Deposits Accumulate and Influence Knock" and "Precombustion Reactions in a Motored Engine" won prominent awards. Both were prepared by Du Pont Petroleum Laboratory engineers.

A VALUABLE SUPPLEMENT

The work of the Petroleum Laboratory is aimed at helping refiners through basic studies which supplement their own research work. In this way the

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OVER

DU PONT

PETROLEUM CHEMICALS DIVISION
NEWS

DU PONT

CONTINUED *"Information Please"*

Petroleum Laboratory can contribute to the over-all knowledge on which improvements in today's fuels and lubricants and new products for the future will be based.

What's more, the work of the Petroleum Laboratory is also supplemented by the more comprehensive research work of the whole Du Pont Company. As a result, many findings of the Experimental Station, the Jackson Laboratory and other Du Pont research facilities can be applied to petroleum industry uses.

If you have a technical problem on which the data from Du Pont's research work may be of help, we suggest that you talk it over with a Du Pont Petroleum Chemicals Division representative.

One of the papers by a Du Pont engineer which received outstanding recognition as a valuable contribution to fuel combustion knowledge.

NEW BOOKLET AVAILABLE ON DU PONT FUEL OIL ADDITIVE No. 2

Last month Du Pont announced the development of a new fuel oil additive. It has both dispersant and stabilizing properties and is known as Du Pont Fuel Oil Additive No. 2. Samples are now being distributed to the petroleum industry.

And to help refiners make the most efficient and economical use of the new additive, Du Pont has prepared a special booklet covering completely its physical properties, applications, effects and methods of addition. Copies are available from any of the Du Pont Petroleum Chemicals Division district offices.

Fuel Research Specialist

LEON F. DUMONT is a group leader at the Du Pont Petroleum Laboratory.

Before entering Drexel Institute in Philadelphia in 1943, he had traveled extensively in Europe and attended school for a year in Brussels, Belgium. Enlisting in the Naval Air Corps in 1944, he was commissioned an Ensign in 1946, at which time he was instructing in amphibious operations. Lee then studied mechanical engineering at Columbia University, receiving his M.S. there in 1948.

He joined the Du Pont Company immediately after college. His first assignment was with the "scavenging group," which conducts research on combustion chamber deposits at the Petroleum Laboratory.

In January, Lee was presented the Horning Award for his paper on "Possible Mechanisms by Which Combustion Chamber Deposits Accumulate and Influence Knock."

LEON F. DUMONT

He is a member of the Society of Automotive Engineers and the American Society of Mechanical Engineers.

What's the Nation-wide Trend in Octane Numbers?

That's a question frequently asked these days . . . especially in view of the fact that engine compression ratios are going higher and higher.

You'll find not only data on the nation-wide trend, but your own competitive standing as well, in the spring edition of Du Pont's Quarterly Motor Gasoline Survey. The results are due to roll off the presses in the middle of April. Refiners can expect to have copies on their desks by the week of April 27.

MOVIES AVAILABLE

Prints of the following Du Pont films are available to oil companies for training and public relations purposes. They may be borrowed or purchased. Address request to nearest Petroleum Chemicals Division district office.

Pipeline on Wheels—A 26-minute, full-color movie on tank truck safety. Suitable for both training and public relations purposes.

What Makes a Gasoline Good—An 18-minute cartoon movie in color. Presents the story of how high quality gasoline is made in easy-to-understand form. Ideal for dealer training meetings.

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Petroleum Chemicals

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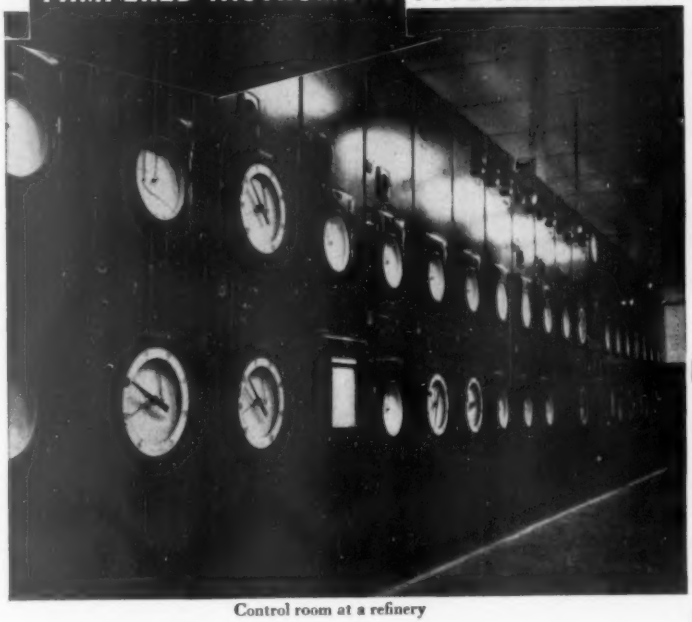
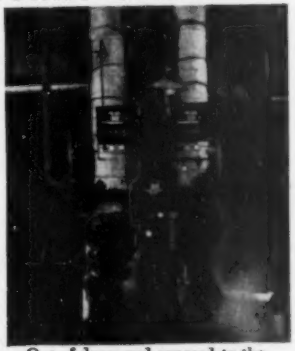
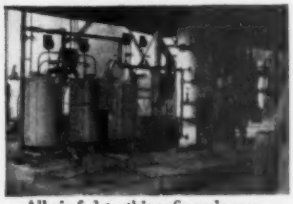
FOR EVERY PAMPERED INSTRUMENT ...DOZENS GET SCANT CARE!



Control room at a refinery



Out-of-doors and exposed to the elements, but dependability is a prime requirement here.



All air fed to this refinery's control instruments is Lectrodryer-DRY and Lectrofilter-CLEAN.

Compensate by feeding them DRY air!

They're building dust-free, air conditioned rooms for control boards in some of the newer plants. But they still have to place many meters, controls and valves out in the weather. Let moisture into the air lines and they're quite likely to have freeze-ups. Mud and rust can form, clogging delicate instrument ports and causing the system to stall.

"Give us Lectrodryers* first to DRY the air", said the instrument men for a prominent oil company in Ohio. Their supervisor had asked if they wanted new instruments or driers. Experience at their Cleveland refinery had shown them the value of feeding DRY air into their control systems.

As you plan new layouts, ask your suppliers to include Lectrodryers in their original bids. Time after time, where driers have been omitted, trouble has developed, making it necessary to add them later at higher cost. Lectrodryer engineers will work with them and you in selecting DRYing equipment for new and old installations.

The book, "Because Moisture Isn't Pink", tells you how many companies have used Lectrodryers for DRYing air, gases and organic liquids. For a free copy, write Pittsburgh Lectrodryer Corporation, 325 32nd Street, Pittsburgh 30, Pennsylvania.

In England: Birlec, Limited, Tyburn Road, Erdington, Birmingham.
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LECTRODRYERS DRY WITH ACTIVATED ALUMINAS

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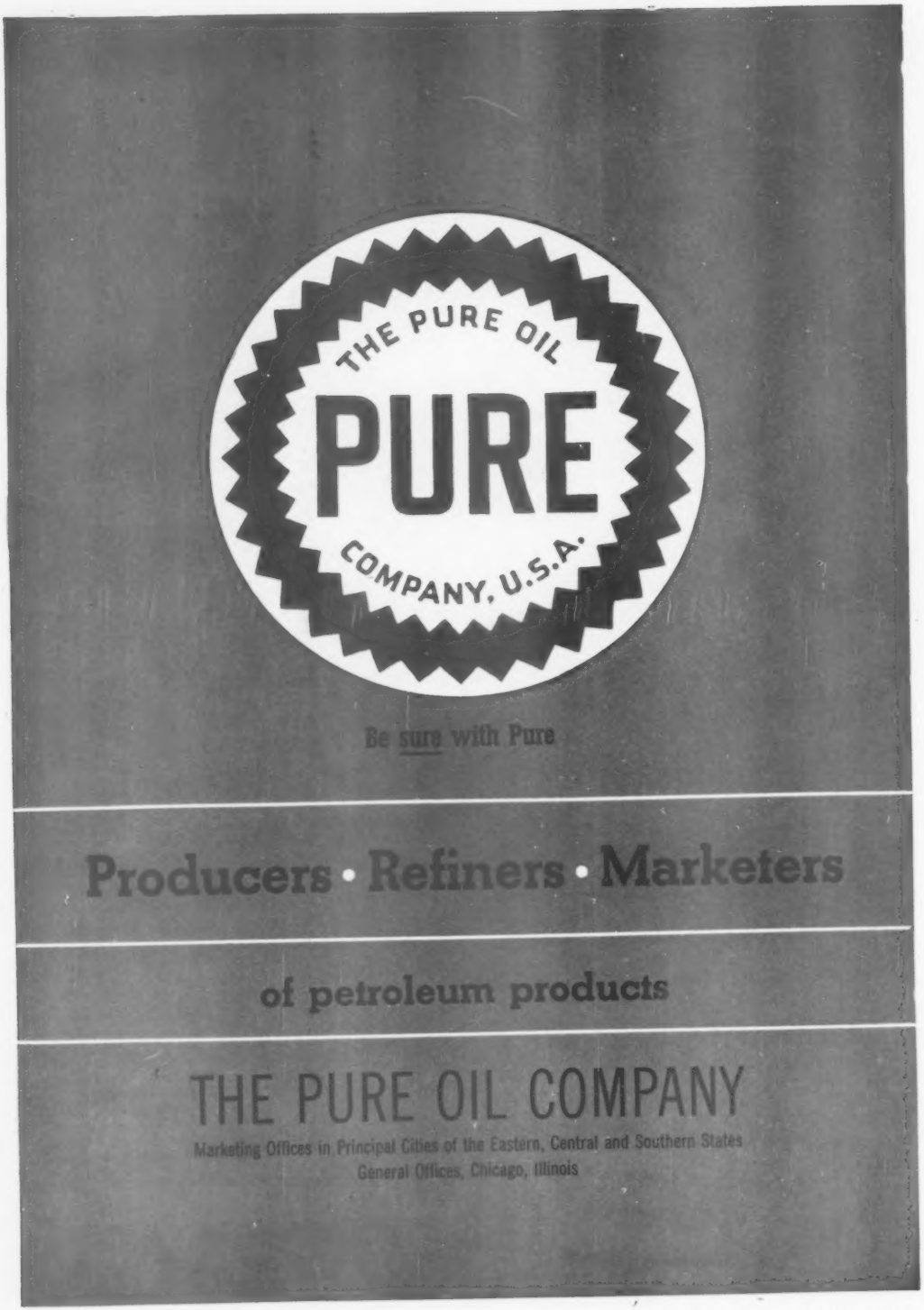
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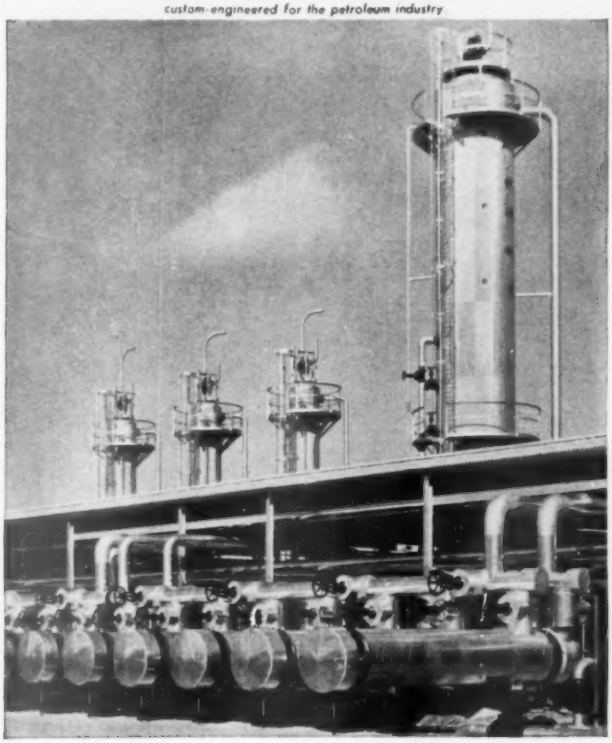
Major refineries from Beaumont to Bagdad rely on Alco heat exchangers and other equipment custom-engineered for the petroleum industry.



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Weights: 100 to 300,000 pounds
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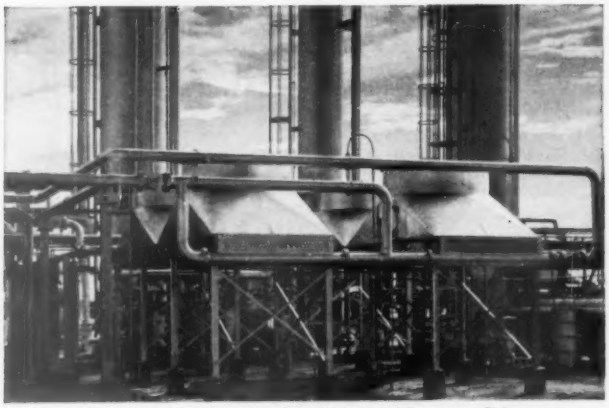

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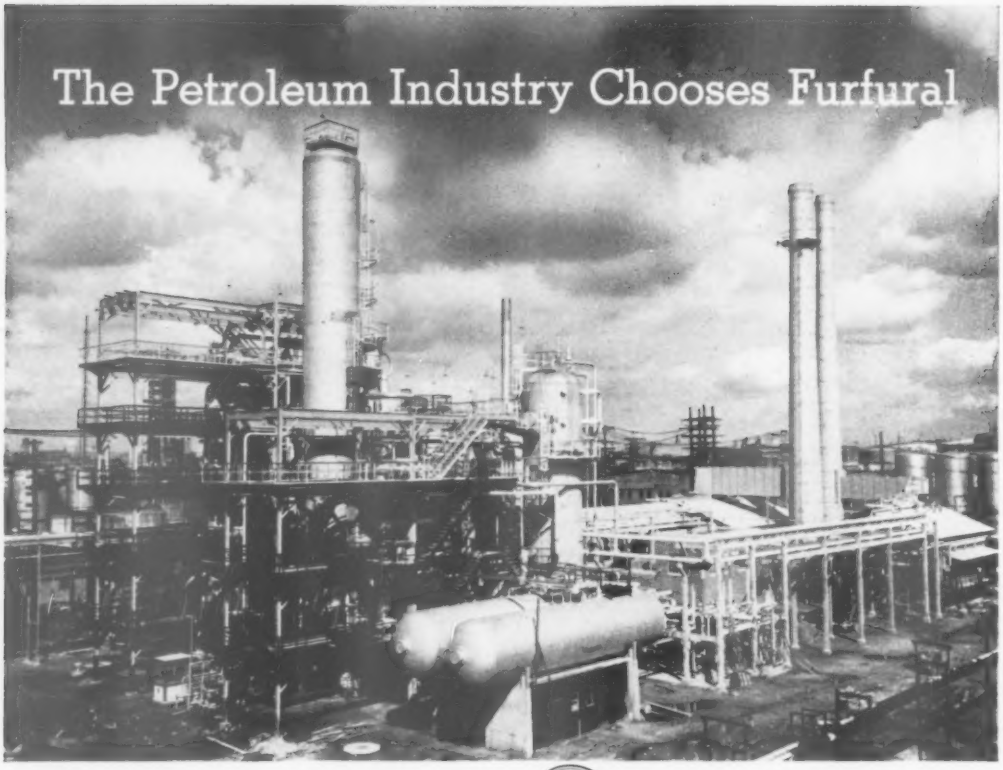
The Petroleum Industry Chooses Furfural



Pictured is the Tide Water Associated Oil Company's solvent extraction plant at Bayonne, New Jersey. This modern, efficient furfural refining unit assures Tide Water of producing high quality lube oils from a variety of crude stocks.

It is enlightening to examine some of the reasons why furfural has been chosen by so many refiners, large and small, as the selective solvent to use for processing lubricating oil.

1. SEPARATION. Furfural is a polar molecule and gives a sharp separation between the mixtures of products present in lube stocks. Its high specific gravity permits rapid phase separation.

2. RECOVERY. Furfural is a very stable compound and may be recovered almost quantitatively for reuse. Furfural is readily recovered from an aqueous solution by steam stripping; it may be recovered from non-aqueous solutions either by flash vaporization, straight distillation, steam stripping, or extraction with water.

3. SAFETY. Furfural is easy to handle and safe to use. Neither vapor nor liquid is excessively toxic; however, the usual precautions in handling organic solvents should be observed.

4. STORAGE. Furfural is shipped in tank cars and is stored in steel tanks. It is generally not necessary to use special handling precautions for cold weather operations; furfural has a low freezing point (−34° F.)

5. AVAILABILITY. Furfural is produced the year around in large quantities at three plants from replaceable raw materials. It is low in price.

• If you would like to know more about the properties of furfural we suggest that you ask for a copy of Bulletin 203. Uses are described in Bulletin 204.

The Quaker Oats Company **CHEMICALS DEPT.**

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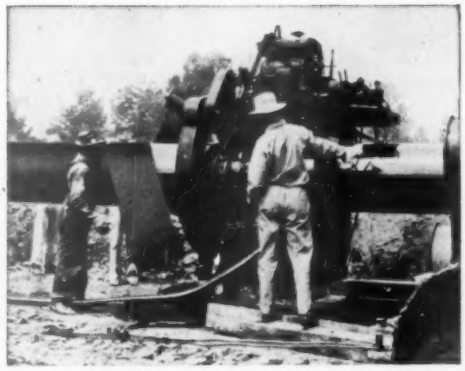
Like the 'Gator's tough skin that shields what's within . . .



Johns-Manville Asbestos Felts shield oil and gas pipelines

Johns-Manville Asbestos Pipeline Felt—*the only type of wrapper that has survived more than 50 years of service in all types of soil*—now protects more than 100,000 miles of oil and gas pipelines!

A sturdy, inorganic product, Johns-Manville Asbestos Felt resists rot and decay, stands up in both acid and alkali soils. It has the thickness and toughness needed to shield pipeline enamels from earth load and soil stresses. And it permits the protective enamel coating to properly function against corrosion.

Johns-Manville Asbestos Felt is flexible; wraps easily without cracking. It guards enamel from impact damage both during installation of field-wrapped pipe, and during transportation and installation of mill-wrapped pipe.

There are important economic advantages, too! In addition to reducing maintenance expense, Johns-Manville Asbestos Felt adds many years of life to the pipeline. For further information and a sample of Johns-Manville Asbestos Pipeline Felt, mail the coupon below.

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Please send me a copy of the sample folder on Johns-Manville Asbestos Pipeline Felt, PP-22A.

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For Temperature Control

$35 Nicholson Trap Replaces $200 Unit

Again demonstrating their remarkable effectiveness as a low-cost temperature control, a large processor reports Nicholson expansion steam traps, at about $35 each, are being installed on outdoor tanks and stills in place of temperature controls. These were costing $110.00 to $200.00, with cost of trap added.

The Nicholson traps are readily adjusted to pass condensate at any temperature below 212° F. No air binding. Lengths 9" to 40". Easily installed, usually without supports. Pressure, 0 to 250 lbs.

FOR ALL EQUIPMENT USING STEAM OR HOT WATER

Dryers, Evaporators, Heat Exchangers, Heaters, Kettles, Paper Machinery, Pipe Coils, Radiators, Retorts, Separators, Steam Stills, Storage Tanks

CATALOG 751

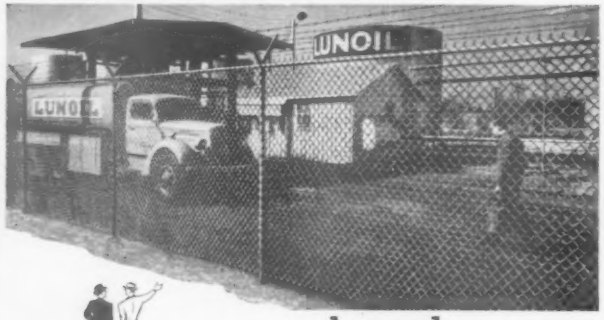
210 Oregon St., Wilkes-Barre, Pa.

W. H. NICHOLSON & CO.

TRAPS · VALVES · FLOATS

PAGE FENCE - Since 1883

• AMERICA'S FIRST WIRE FENCE •



When you think of hazards think of PAGE, the pioneer name in fence protection for persons and property. Security is a job for Page Chain Link Fence, available in heavily galvanized Copper-Bearing Steel, rust-immune Stainless Steel or corrosion-resisting Aluminum. But this pioneer name means more than a quality product. It is a complete fence service, performed by more than 100 firms having technical training and fence erection know-how, and conveniently located throughout the country. For Page Fence data and name of firm nearest you—

Write to PAGE FENCE ASSOCIATION in Monessen, Pa., Atlanta, Bridgeport, Chicago, Denver, Detroit, Los Angeles, Philadelphia, New York or San Francisco.

PRODUCT OF PAGE STEEL & WIRE DIVISION OF AMERICAN CHAIN & CABLE COMPANY, INC.

They Say—

What Next in Integration?

There once was a Frenchman named
Gene
Who invented a cracking machine
Through a catalyst bed
Oil vapors he sped
The result was pure cracked gasoline.

Then Socony and Sun joined his crew
Determined to build something new
Made the catalyst pass
Right through the hot gas
In countercurrent flow, a la Pew.

Newer features they added galore
Glass beads flew about by the score
Butenes came from butane
And propenes from propane
The result they called "thermofor."

Inventions move on at high pace
There's no end to the technical race
Southwest Engineering
A crowd that we're fearing
Did something to achieve the first place.

With Socony they did something new
Outdoing both Houdry and Pew
Pre-fab units swing
From an oil derrick thing
And the thermofor's right there in view.

We might say of this cracking machine
"The durndest thing ever yet seen"
But the progress they've made
Puts us all in the shade
And inspires a new technical dream.

Perhaps, next year, the whole nation
Will be stirred by a new integration
An oil derrick tied
To a cat cracker's side
And merged with a nice service station.

Bruce K. Brown, president, Pan-Am Southern Corp., speaking at a banquet in Wichita, Kans., following the formal dedication of new processing units at the Vickers Petroleum Co. refinery.

Anti-Gas Bill

"In the almost 16 years we have been storing gas in underground pools, there has not been, to our knowledge, one mine death or injury which could be attributed to this source.

"We feel, therefore, that we are the unfair target of the unjust and unverified accusations that are implied in the Kent anti-gas storage bill.

"The bill discriminates against the gas-consuming public, and would, by

Are your high temperature tubes giving you the best life/cost ratio? *Ask the experts!*

This month's report is on: **DM STEEL**

Has unusually high creep strength for a pearlitic steel, good stability up to 1200° F., fairly good corrosion and oxidation resistance. Has 2 to 3 times the life of carbon steel where corrosion is not severe. Recommended for cracking furnace tubes, hot oil lines, superheater tubes, high temperature steam piping and forgings for accessory parts.

ONE OF 24 TIMKEN HIGH TEMPERATURE STEELS

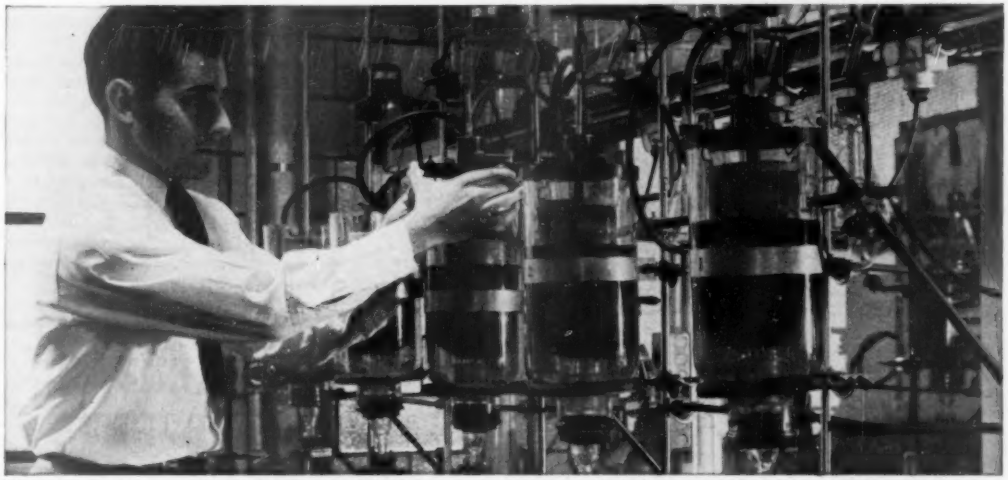
Carbon	Sicromo 2	Sicromo 5S	18-8 Ti
Carbon-Mo.	Sicromo 2½	Sicromo 5MS	16-13-3
DM-2	2½% Cr.-1% Mo.	Sicromo 7	25-20*
Silmo	Sicromo 3	Sicromo 9M	25-12*
DM	4-6% Cr.-Mo.	18-8 Stainless	35-15**
2% Cr.-Mo.	4-6% Cr.-Mo.-Ti.	18-8 Cb	16-25-6**

**Available as seamless tubing on an experimental basis only.*
***Not available as seamless tubing.*

CHANCES are there are several high temperature tube steels that will solve your particular combination of heat, pressure, oxidation and corrosion problems. But there's only *one* analysis that will give you the best life/cost ratio.

The best way to find that one steel is to *ask the experts*—metallurgists of The Timken Roller Bearing Company. They're recognized authorities on high temperature steels, backed by 20 years' experience. With 24 different analyses to choose from, they'll help you pick the steel that's best suited for your particular application. And you'll be assured of uniform quality in every tube because the Timken Company rigidly controls the quality of the steel from melt shop through final inspection.

Let the Timken Company's RSQ—Research, Supply, Quality—solve your tube problems. *Ask the experts!* The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".



Electrolytic equipment used in Timken Company laboratories to extract non-metallic inclusions from steels in research on steel cleanliness.

YEARS AHEAD—THROUGH EXPERIENCE AND RESEARCH

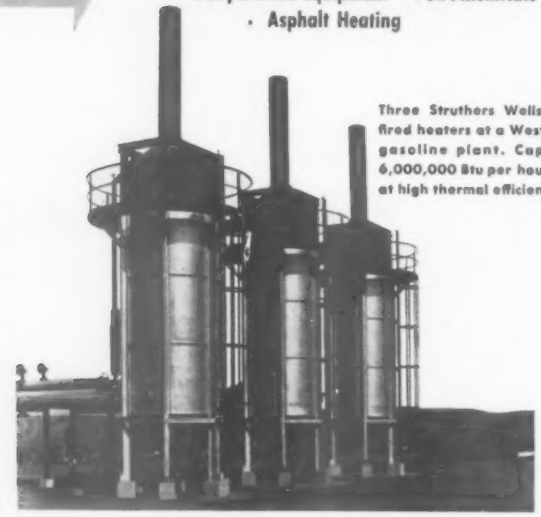
SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS TUBING

Struthers Wells

FIRED HEATERS

Used by Leading Oil Companies

for Rich Oil Heating for Gasoline Plant Service · Indirect Heating for Grease Kettles · Steam Superheating · High Temperature Gas Heating · Dehydration Equipment · Petrochemicals · Asphalt Heating



Three Struthers Wells direct fired heaters at a West Texas gasoline plant. Capacity: 6,000,000 Btu per hour each, at high thermal efficiency.

Where indirect heating is utilized, the circulating medium may be oil or Dowtherm, with the Dowtherm used in vapor or liquid phase.

Heating systems may be supplied complete with all instruments, controls, and burners.

High thermal efficiencies may be secured, if desired, using finned tube convection surface.

Heaters to about 10,000,000 Btu may be shipped completely assembled and ready for field erection, except for structural platforms, and stacks. Larger units are field assembled, but require a relatively small amount of labor.

Quick deliveries are available in an extensive line of standard sizes.

Struthers Wells

STRUTHERS WELLS CORPORATION

WARREN, PA.

Plants at Warren and Titusville, Pa.

Representatives in Principal Cities

its provisions, impose a hardship on thousands of persons not associated with the gas industry."

John J. Jacob, Jr., executive vice president, Peoples Natural Gas Co., Pittsburgh.

Profit in a Nutshell . . .

"While the profit system does not guarantee a p r o f i t, it contemplates that every business will at least try to make one, and that no business shall long endure which does not succeed in making one. Business losses are free society's thumbs down on companies and on activities within companies that do not earn the right to survive."

Herbert Willetts, director of domestic marketing, Socony-Vacuum Oil Co., Inc., addressing the Illinois Petroleum Marketers Association, Chicago.

Outlook for Construction

"Look to electrical and nonelectrical machinery, rubber and beverage industries to increase their plants as well as the petroleum and chemical industries. Electric and casualty companies will continue to be strong investors in new facilities.

"One more industry is of increasing importance — f o r e i g n construction. Every day we hear of plans for new world projects—both private and governmental. The position of the United States is becoming world dominant and the foreign market for construction is enormous."

John P. Yates, senior vice president, Bechtel Corp., addressing the San Francisco convention of the American Society of Civil Engineers.

CALENDAR OF EVENTS

APRIL

1- 9 American Association of Oilwell Drilling Contractors, eighth annual drilling industry safety clinic, Baker Hotel, Dallas.

7- 8 American Gas Association, research and utilization conference, Hotel Statler, Cleveland.

7- 9 Petroleum Industry Electrical Association, annual convention and exhibit, Shamrock Hotel, Houston.

8- 9 American Association of Oilwell Drilling Contractors, eighth annual drilling industry safety clinic, Baker Hotel, Dallas.

8-10 American Petroleum Institute, division of production, Eastern district meeting, William Penn Hotel, Pittsburgh.

9-10 Petroleum Engineering Conference, University of Kansas, Lawrence.

9-10 American Association of Oilwell Drilling Contractors, eighth annual drill-

10 WAYS BETTER

- Uniform Wall Thickness
- Strong, Sound Welds
- Round and Straight
- Easy to Weld
- Free from Scale
- Free from Surface Defects
- Long Lengths
- Easy to Contour-bend
- High Yield Point
- Precision Made

UNIFORM WALLS FOR WELDING . . .

Republic Electric Weld Line Pipe

REPUBLIC Electric Weld Line Pipe is formed from flat-rolled steel . . . the same thickness from side to side and end to end. The result is line pipe that is uniformly thick, uniformly concentric from end to end. *You* benefit because your crews can line-up ends quickly and welding crews can produce uniform weld beads at uniform speeds.

Clean surfaces inside and out provide freedom from holidays in protective coatings, prevent clogged valves and regulators caused by scale loosened after blowing-out the line.

Across the nation, more than 67,000 miles of Republic Electric Weld Line Pipe and 24 years service on many of these miles prove that Republic is the name to specify for pipe on transmission, gathering, products, and distribution lines.

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GENERAL OFFICES • CLEVELAND 1, OHIO
Export Department: Chrysler Building, New York 17, New York

Republic
REPUBLIC STEEL
ELECTRIC WELD LINE PIPE

Other Republic Products include Casing and Tubing—Carbon, Alloy and Stainless Steels—Studs, Bolts and Nuts—Heat Exchanger Tubes

PROOF

HERE'S HOW TAPECOAT® HAS STOOD THE TEST OF TIME TO SOLVE CORROSION PROBLEMS

PROOF (Underground) — Inspection of TAPECOATED joints after 10 years of underground service showed no sign of corrosion when the TAPECOAT was removed.

PROOF (Alternate wetting and drying) — Expense and trouble in protecting lines subject to wet and dry conditions at cooling towers have been eliminated since 1944 by coating with TAPECOAT.

PROOF (Underwater)—During the re-laying of an underwater pipe line in the Gulf area, examination showed that TAPECOAT had protected the pipe against salt water corrosion and barnacles.

PROOF (Above ground)—A gas line at a bridge crossing was TAPECOAT-protected in 1944. There has been no need for attention and no interruption of service since the pipe was TAPECOATED.

Actual experiences like these show what TAPECOAT coal tar protection can do for you.

Use TAPECOAT to combat corrosion above or below ground on gathering lines, transmission lines, meter stations, compressor stations, distribution lines, pipe joints, bolt-type couplings, fittings, large bends, large diameter pipe, insulated lines, tanks, and other surfaces subject to corrosion.

Write for descriptive brochure and prices

The TAPECOAT Company

Originators of Coal Tar Tape Protection

1539 Lyons Street, Evanston, Illinois

ing industry safety clinic, Baker Hotel, Dallas.

10 San Joaquin Valley Oil Producers Association, annual dinner meeting, Bakersfield Inn, Bakersfield, Calif.

13-15 American Society of Lubricating Engineers, eighth annual meeting, Hotel Statler, Boston.

15-17 National Petroleum Association, midyear meeting, Cleveland.

20-22 American Petroleum Institute, Division of Transportation, products pipe-line conference, Hotel Muehlebach, Kansas City.

21 Association of Consulting Chemists and Chemical Engineers, Inc., Hotel Belmont Plaza, New York City, symposium and dinner.

21-23 Southwestern Gas Measurement Short Course University of Oklahoma, Norman.

22-23 Texas Petroleum Research Committee, sixth oil-recovery conference, Texas A. & M. College, College Station.

22-24 American Association of Petroleum Geologists, Rocky Mountain section meeting, Casper, Wyo.

22-24 American Institute of Electrical Engineers, southern district meeting, Hotel Seelbach, Louisville, Ky.

24-25 Interstate Oil Compact Commission, spring meeting, Roosevelt Hotel, New Orleans.

26-29 American Institute of Chemical Engineers, Chemical Institute of Canada, joint meeting, Royal York Hotel, Toronto, Ont.

27-28 Independent Petroleum Association of America, mid-year meeting, Jefferson Hotel, St. Louis.

APRIL 27-
MAY 1 American Petroleum Institute, safety and fire protection committees sixth mid-year meeting, Galveston, Tex.

28-30 American Society of Mechanical Engineers, spring meeting, Deshler-Wallick Hotel, Columbus, Ohio.

Apr. 29-
May 1 Natural Gasoline Association of America, annual convention, Rice Hotel, Houston.

Apr. 30-
May 1 American Gas Association, transmission and storage conference, Edgewater Beach Hotel, Chicago.

MAY

4- 5 American Petroleum Institute, division of marketing, midyear meeting, Baker Hotel, Dallas.

4- 6 Liquefied Petroleum Gas Association, annual convention, Conrad Hilton Hotel, Chicago.

5- 6 Gas hydrate control conference, University of Oklahoma, Norman.

6- 8 American Society of Training Directors, ninth annual conference, Sheraton Plaza Hotel, Boston.

7- 8 American Petroleum Institute, Rocky Mountain district, Division of Production, spring meeting, Gladstone Hotel, Casper.

8 Society of Exploration Geophysicists, Pacific Coast Section, annual spring meeting, Hotel El Tejon, Bakersfield, Calif.

11-13 Southern Gas Association, Jung Hotel, New Orleans.

11-14 American Petroleum Institute, Division of Refining, midyear meeting, New York.

13-14 Pacific Coast Gas Association, annual gas supply and transmission conference, Santa Barbara, Calif.

14 Conference on Instrumentation in Water, Sewage, and Industrial Waste Treatment, Manhattan College, New York.

in this little bag of beans

42

sizes of economical

UNIBOLT

- Christmas Tree Flow Manifolds
- Positive Chokes
- Cage Nipples
- Tees and Crosses
- Couplings and Blanking Plugs

FLOW-RATED X-BEAN INSERTS UNDER 1 1/64ths

total of 74 sizes of X-BEANS up to ½ inch!

UNIBOLT Flow Rated X-Beans, for use with UNIBOLT Choke Bodies and Cage Nipples exclusively, are drilled in increments of 5 percent and 10 percent of *well flow* rather than in increments of 1/64-inch. Consequently, the flow of fluid or gas can be positively controlled with a degree of accuracy never before attained. If, for example, a well produces 10 bbls. through a 1/64-inch choke, to increase the choke to the next largest fractionally drilled size, 2/64-inch, would increase the production to approximately 40 bbls. On the other hand, a well that produces 10 bbls. through a size X-35 UNIBOLT X-Bean would produce only 10½ bbls. through the next largest size X-Bean, X-35.5; 11 bbls. through an X-36, and so on.

This accurate control of production is a safeguard against the harmful effect of periodically pulling a well too hard in order to make its allowable.

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NATURAL GASOLINE MEN

GREETINGS

from the

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We are looking forward to seeing you at the
THIRTY-SECOND ANNUAL CONVENTION
of the

NATURAL GASOLINE ASSOCIATION OF AMERICA

April 29, 30 and May 1, Rice Hotel, Houston, Texas

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The Wickes Boiler Co.
Woobank Machinery Company
World Petroleum
Worthington Corp.
Wyatt Metal and Boiler Works
Young Sales Corp.
John Zink Burner Company

14-23 International Petroleum Exposition, Tulsa.

15-16 International Gas Union, council meeting, Paris, France.

19-22 The Institute of Gas Engineers, ninetieth annual meeting, London, England.

21-23 Panhandle Geological Society, field trip, Yucca Hotel, Raton, N. M.

24-27 American Gas Association, production and chemical conference, Hotel New Yorker, New York City.

25-28 Air Pollution Control Association, annual meeting, Lord Baltimore Hotel, Baltimore, Md.

25-29 American Society of Mechanical Engineers, annual conference and exhibit, oil and gas power division, Hotel Schroeder, Milwaukee.

27-29 Texas College of Arts and Industries, Kingsville, eighth annual short course in gas technology.

28-29 Western Petroleum Refiners Association, regional technical-industrial relations meeting, Broadview Hotel, Wichita.

28-29 Natural Gas and Petroleum Association of Canada, London, Ont.

29-30 West Texas Geological Society spring field trip, Paisano Hotel, Marfa, Tex.

JUNE

2- 3 American Petroleum Institute, Division of Production, Pacific Coast District, Statler Hotel, Los Angeles.

4- 5 Kentucky Oil and Gas Association, annual meeting, Lafayette Hotel, Lexington, Ky.

7-12 Society of Automotive Engineers, summer meeting, The Ambassador and Ritz-Carlton Hotels, Atlantic City, N. J.

14-18 Canadian Gas Association, Windsor Hotel, Montreal, Canada.

15-19 American Petroleum Institute, Division of Production, midyear committee conference, Hotel William Penn, Pittsburgh.

16-19 American Welding Society, national spring technical meeting, Shamrock Hotel, Houston.

JUNE 16-JULY 2 Intensive Course and Research Conference on Phase Behavior of the Hydrocarbons, University of Michigan, College of Engineering, Ann Arbor.

18-19 Western Petroleum Refiners Association, regional technical-industrial relations meeting, Conrad Hilton Hotel, Chicago.

18-19 Pennsylvania Grade Crude Oil Association, annual meeting, Hotel William Penn, Pittsburgh.

June 28-July 2 Petroleum Equipment Suppliers Association, annual meeting, Broadmoor Hotel, Colorado Springs, Colo.

JUNE 29-JULY 3 American Society for Testing Materials, annual meeting, Chalfonte-Haddon Hall, Atlantic City, N. J.

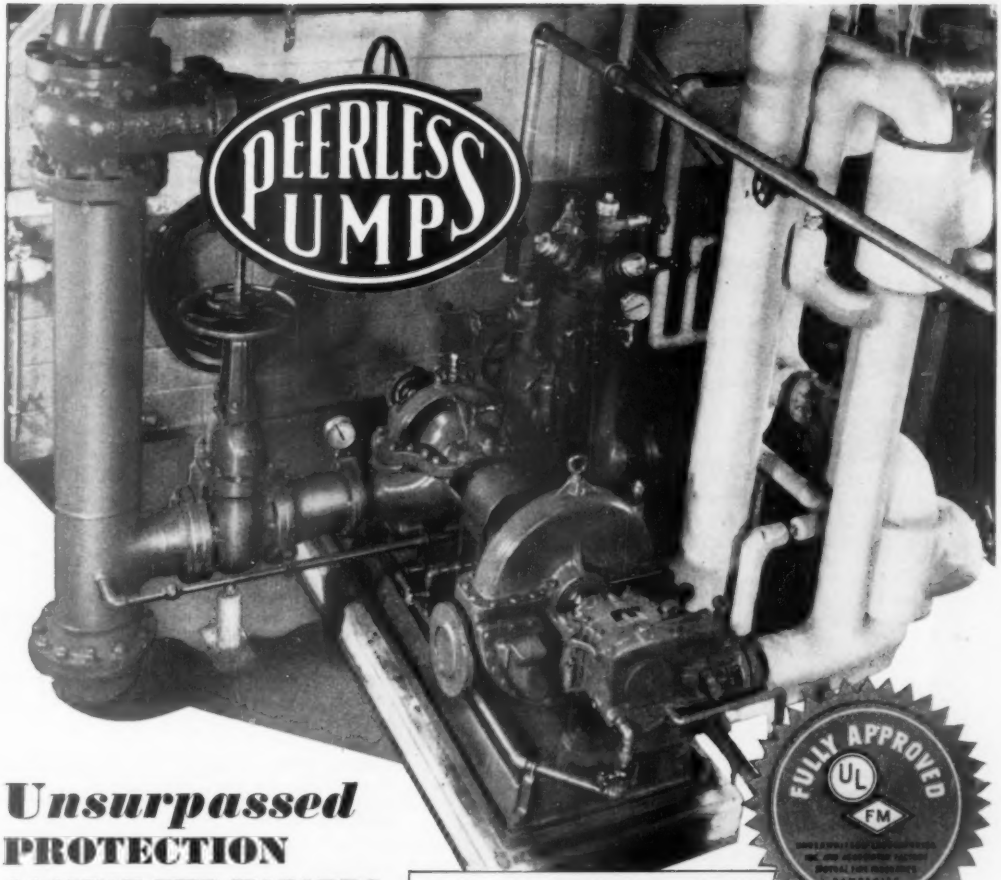
JULY

July 30-Aug. 1 Wyoming Geological Association, eighth annual field conference, University of Wyoming, Laramie.

AUG.

17-19 Society of Automotive Engineers, international West Coast meeting, Georgia Hotel, Vancouver, B. C., Canada.

18-21 American Institute of Electrical Engineers, Vancouver Hotel, Vancouver, B. C.



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2. *APPROVED AUXILIARY EQUIPMENT*
3. *SKILLED APPLICATION SERVICE*

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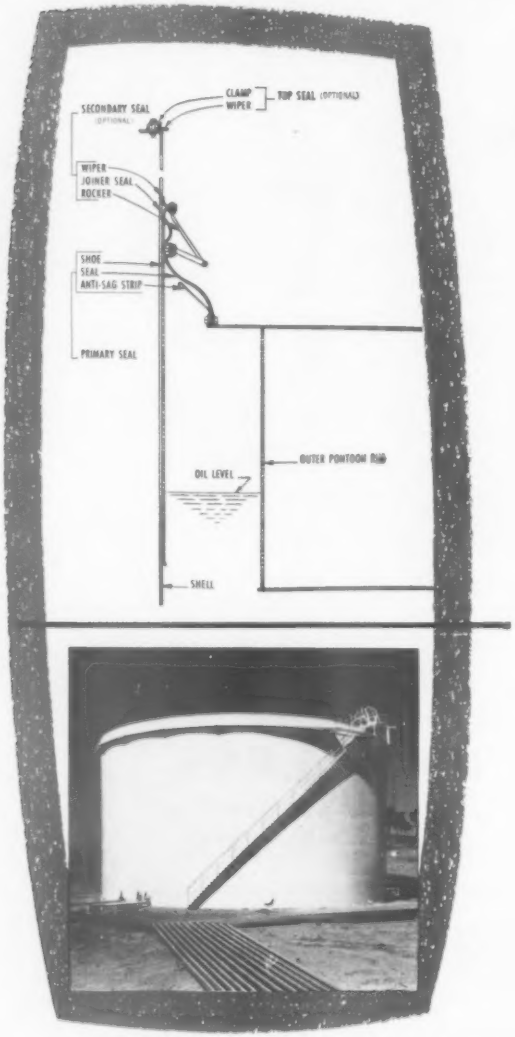
number 1 of a series



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top seal—stops vapor losses when roof is operating in upper 3 feet of tank. You get full tank capacity without increasing shell height. A patented Wiggins exclusive feature.

secondary seal—Neoprene-coated fabric ring and joiner curtain cuts costly wind losses. Saves 50% of evaporation losses suffered by tanks having only a single seal.

primary seal—long limber metal shoe assures positive, constant contact with tank shell—regardless of shell irregularities. Patented anti-sag device prevents accumulation of water and dirt in seal fabric.

Other Vital Wiggins Conservation and Safety Features

Pontoons

- divided into *gas-tight* compartments for safety
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- uncluttered with framework, easy to inspect

Drainage

- complete, clean drainage assures protection against peeling of paint, rusting, and dangerous accumulation of water

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- roof designed to take *all loads* to which it may be subjected with a better than normal safety factor

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- full use of tank capacity for in and out storage

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GENERAL AMERICAN TRANSPORTATION CORPORATION

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JOURNAL
TULSA, OKLAHOMA

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●

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JOURNALLY Speaking

The P. O. vs. Us

LAST November 5 one of our Democratic friends disgustedly remarked that he couldn't see that things were a bit better as a result of the election, and what about all those fine-sounding Republican campaign promises to improve everything.

We don't want to be put in the class of those who expected miracles overnight, but the sad truth is that we can see very little improvement in the Post Office Department even though the Eisenhower people have been in control there for more than 2 months.

Our beef is about the slow delivery of our favorite oil publication to the world's most valued readers: youse guys, our subscribers. Here we bust a gusset every week to get the Big Yellow Book out firstest with the mostest red-hot news of the oil industry and then what happens? Then the copies lie around post offices all over the country while our would-be readers fume and chew their fingernails waiting for delivery.

How do we know? We asked. Our Circulation Manager sent questionnaires to readers in 25 representative oil towns in various parts of the country asking when they got delivery.

As you know, the Journal is dated Mondays, and it's put on the mail trains in Tulsa in ample time to be delivered on Mondays in just about every metropolis, town, and village that's on a railroad and has carrier delivery service. But our survey showed that fewer than three-fourths of our subscribers got Monday delivery. In a good many places more than half the copies dribbled in on Tuesday, Wednesday, and Thursday. One poor guy didn't get his copy until Friday, but he lives on Long Island and you've heard tales about that Long Island Railroad.

Now this might be chalked up against the railroads except for the fact that in all but two cities some of the subscribers got their copies on Monday and in several places some of them received the Journal on Sunday—probably by going to their own lock boxes at the post office. This proves that the copies got to the town all right and that the post office made a start at "working" them. Since all copies to one city leave Tulsa in closed mail bags, it's a safe bet that if one copy gets to your town in time for Monday delivery they all get there.

If you don't get your copy on Monday the chances are better than 10 to 1 that the fault lies right in your own local post office. In case you give a darn about getting your Journal promptly—and we will be just awfully downhearted if you don't—the thing for you to do is to bellyache to your postmaster. The chances are that your postmaster isn't an oil man and so doesn't realize how terrifically imperative it is that you keep right up to the minute with all the doings of this fast-moving oil industry.

And don't let your postmaster lull you into innocuous desuetude by any sad tale about his small budget and lack of equipment. Pound on the table and tell him you paid your taxes and voted for Ike and you expect service with a capital S. Give him a pep talk about his slogan to the effect that neither rain nor hail or whatever is supposed to keep the mail from going through. Tell him never mind about those bills from your creditors or your wife's fashion magazine, but get that Oil and Gas Journal to you every Monday. Threaten to write your congressman.

Not all post offices are at fault. Our subscribers got 100 per cent Monday delivery in Baytown, Tex.; East Chicago and Whiting, Ind.; Cleveland, Ohio; Linden and Bayonne, N. J.; and Denver, Colo. As the rooster told the hens about the ostrich egg, this shows what can be done.

About a year ago we made a similar survey of postal delivery and wrote a piece about it which stirred up quite a ruckus. It did some good. Some of the post offices which had punk service then get gold stars now. But others have deteriorated, so that the average for the country as a whole isn't a bit better.

As long as we address your copy properly and get it on the train in time there s nothing more we can do about it. You know whether or not you're getting good delivery service. If you don't like it, holler.

—Henry D. Ralph.

YOU CAN SAVE CASING

BY STAGE CEMENTING THE BAKER WAY

With *only one* string of casing you can cement off at the shoe *and* shut off surface water. Or you can cement a well with *two producing zones* and be assured of a good cement job for the upper zone. And you *never* need risk breaking down a comparatively weak formation by high cementing pressure and the extreme weight of a long cement column.

IT'S SIMPLE, SPEEDY AND SAFE to perform two-stage cement jobs with Baker Stage Cementing Collars (Product No. 200-F) in combination with other Baker Equipment. In addition to positive, mechanical closing of the cementing ports upon completion of the second stage, you are assured of these outstanding advantages:

1. After the second stage has been completed, an external steel sleeve with an oil-resistant synthetic rubber seal provides positive closure and prevents passage of fluid between the inside and the outside of the casing, regardless of the condition of the cement job at that point.

BAKER STAGE CEMENTING COLLAR

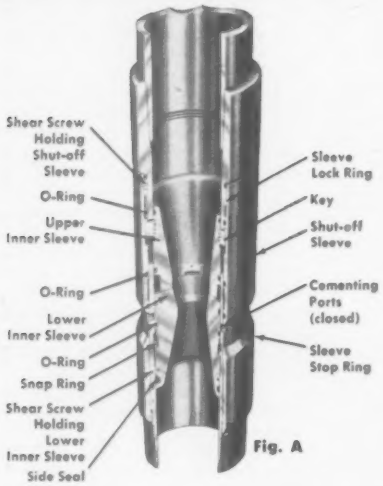


Fig. A

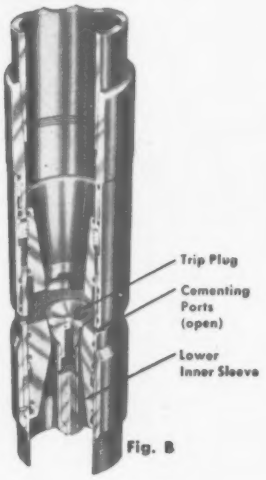


Fig. B

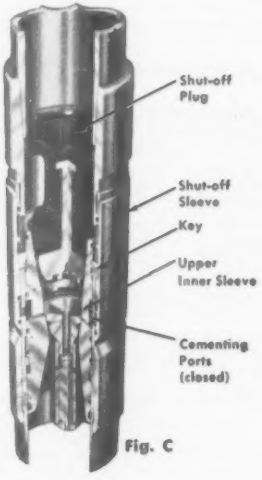


Fig. C

Fig. A—Ready for cementing the first stage. The cementing ports are covered by the Lower Inner Sleeve which is held in position by shear screws; shear screws also hold the Shut-Off Sleeve above the cementing ports.

FIG. B—Ready for cementing the second stage. After the Trip Plug is seated, application of hydraulic pressure shears the screws holding the Lower Inner Sleeve which moves downward, thus uncovering the cementing ports. The Trip Plug prevents passage of fluid into the casing below, and cement pumped into the casing will now pass through the cementing ports for the second-stage cementation.

FIG. C—Second-stage cementation is completed. The Shut-Off Plug has been pumped down the casing and pressure applied to shear the screws and move the Shut-Off Sleeve downward to close off the cementing ports. Note how the Sleeve Lock Ring has expanded to lock the Shut-Off Sleeve in position permanently covering the cementing ports.

2. The cementing ports of the Stage Cementing Collar may be opened at any time after completion of the first stage, and fluid may be circulated through the stage collar for any desired length of time before starting second-stage cementing.
3. Operation of the stage collar is effected by fluid pressure applications only, and no movement of the casing is required after the first stage of the cementation has been completed.
4. All internal parts of the Baker Stage Cementing Collar are constructed of readily drillable materials, and when drilled out there are no sharp shoulders or irregularities to interfere with the subsequent passage of tools through the collar.
5. Since the steel Shut-off Sleeve is on the outside of the Stage Cementing Collar, there is no possibility of accidentally opening the cementing ports when drilling out the internal mechanism, or later when bits or casing scrapers are run through the collar.

Ask any Baker representative or office for recommendations to make your stage cementing operations successful, "first-time" accomplishments.

BAKER OIL TOOLS, INC.

HOUSTON • LOS ANGELES • NEW YORK

One company tells what to do about rising costs

HERE are excerpts from the annual report of a medium-sized integrated oil company.

"In 1952 the company produced more crude oil, drilled more wells, completed more producing wells, had the highest number of producing wells at the end of the year, processed more crude oil through its refinery, produced and sold more refined products, had the highest working capital at the end of the year and the largest gross income of any previous year in the company's history.

"The net profit of the company was approximately 6 per cent less than that of the preceding year. Deeper and more costly drilling is having its effect on the net profit per barrel being obtained from new production.

"AS an illustration, the unit cost chargeable against each barrel of the company's production, to provide for the depletion of drilling and leasehold costs and depreciation of equipment, averaged 17½ cents per barrel in the year 1942 as compared with 44½ cents for the year 1952. The average for 1947, the year in which the last crude-oil price increase was effective, was 23 cents per barrel.

"In 1947 the company completed 31 wells at an average cost of $54,180 and an average depth of 5,569 ft., or $9.73 per foot. In 1952 the company completed 98 wells at an average cost of $72,899 and an average depth of 6,712 ft., or $11.01 per foot.

"It is apparent that the producing branch of the oil industry cannot continue indefinitely to search for new sources of crude through deeper and more costly drilling without a compensating increase in the price of crude oil.

"The industry . . . cannot continue to spend 4 billion dollars annually, as it did last year, in the search for new sources of petroleum and in the development and expansion of productive facilities, so long as it is compelled to meet the destructive competition of excessive imports.

"THE oil industry has been able to exist during these 6 years (since the last price increase) only because it has been drawing upon reserves that were discovered and developed at the lower costs prevailing from 15 to 25 years ago. These low-cost reserves are steadily being exhausted and an ever-increasing percentage of production is coming from the discoveries and developments of the much higher cost postwar period.

"It is obvious that the key to the solution lies in a realistic adjustment of imports. Once that adjustment is made, the door will be open to a fair and adequate price, which, in turn, will furnish the green light for accelerated exploration and development with a consequent increase in reserves, facilities, and surplus productive capacity."

These statements seem to be typical of the conditions reflected and the views expressed or implied in a great many other annual reports being issued currently.

7½ TON FORGINGS

NICKEL ALLOYED STEEL FORGINGS for the new $55,000,000 Mid-Valley pipe line ... a joint undertaking of Sun Oil Company and Standard Oil of Ohio ... built to carry 150,000 gallons of oil daily through pipe of 20" and 22" diameter. These rings are 83" OD x 76" ID, with a face width of 21".

How Nickel Alloyed Steel Strengthens Gears that Power a Pipe Line

These giant ring gear blanks weigh 7½ tons each...

This pair is from a batch being forged, heat-treated and rough-machined at The National Supply Company's plant in Torrance, California.

After teeth are cut and finished, all will serve in pumping stations along the new 100-mile Mid-Valley pipe line.

These nickel alloyed steel forgings will form the outer rims of bull gears in eight 1700-horsepower speed-increaser units... the largest ever built for pipe lines in this country.

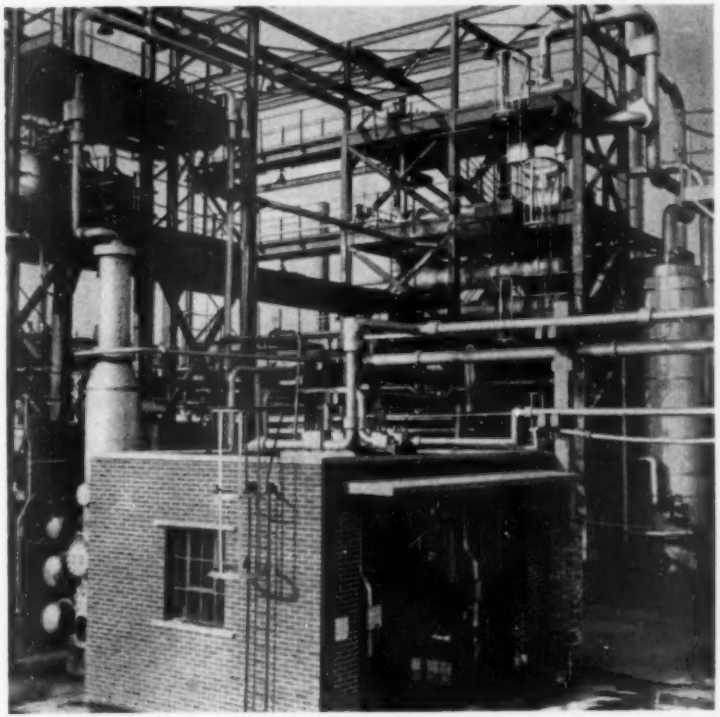
National Supply engineers specify Type 4340 nickel-chromium-molybdenum steel for these ring gears, to assure ample strength, toughness and wear resistance. Excellent depth hardening properties make Type 4340 particularly desirable for heavy duty forgings. Moreover, outstanding fatigue strength characterizes this nickel alloyed steel.

INCO booths Number 64 & 65

EMBLEM OF INCO SERVICE

THE INTERNATIONAL NICKEL COMPANY, INC. 67 WALL STREET NEW YORK 5, N. Y

THIS WEEK



WORLD'S FIRST Autofining unit is shown here in operation at the Llandarcy, South Wales, refinery of National Oil Refineries, Ltd. The Autofining unit, developed by Anglo-Iranian Oil Co., Ltd., is now considered by Anglo-Iranian to be fully proved after 6 months of operation. The process desulfurizes a wide variety of feed stocks ranging from natural and straightrun gasolines to gas oils and diesel fuels.

INTERNATIONAL.— American Independent Oil Co. cores 258 ft. of oil pay in Neutral Zone wildcat in formations resembling those in Burghan field in Kuwait. . . . Company prepares for 2.3-mile northwest stepout. . . . ¶Anglo-Iranian moves to set up the first quality price differential in the Middle East with a cut of 15 cents per barrel in its price for Kuwait crude. . . . ¶Israeli Government grants exploration rights to seven independent firms. . . . ¶Caltex reveals it will build a new refinery of about 10,000 bbl. capacity in Vishakapatnam in India. . . . The Caltex plant would be the third new refinery scheduled to be constructed in India. . . .

NATURAL GAS. — All flaring in Spraberry Trend halted as Railroad Commission order closing in field becomes effective. . . . Estimated 20 per cent of wells connected to gasoline plants marketing their residue gas remain open. . . . Hearing on injunction against commission for operators still producing scheduled for April 22. . . . ¶Texas' gas-gathering tax appealed by three pipe-line companies to state Supreme Court. . . . State now has more than $13,000,000 in protested payments. . . . ¶Gas-injection program which would eliminate flaring and boost oil recovery in Cree-Sykes and Cree-Sykes East fields outlined by Union Sulphur & Oil Corp. . . .

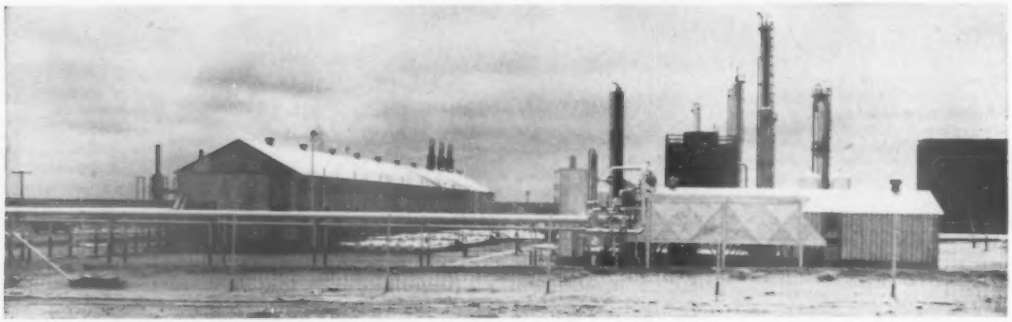
ACTIVITY.—Production of crude and lease condensate averaged 6,497,475 bbl. daily for week ended March 28, up 1,725 bbl. daily. . . . ¶Total well completions for the week increased 44 wells to 900. . . . ¶Wildcat completions were up 15 wells for the week to 218 compared with 163 for same week last year. . . . ¶Rotary rigs operating in United States on March 30 totaled 2,480, down 30 rigs for the week and 230 below same date last year. . . .

TRENDS.—Seasonal shifts in major product stocks are following last year's pattern. . . . Gasoline stocks on March 28 were down slightly for the week, and distillate stocks made the first gain of the season. . . . Last year, the high point for gasoline stocks and the low points for kerosine and distillate fuels came on March 29. . . .

WATER FLOODING.—Texaco reports pilot flood on 640 acres in Cut Bank field in Montana is increasing production appreciably. . . . ¶Floods now being started in several pools in North Texas should soon settle whether or not hydraulic fracturing of an oil formation will interfere with subsequent water flooding, N.T.O.G.A. speakers agree. . . . ¶Kewanee Oil Co. begins drilling program preparatory to flooding new area of Stanley Stringer in Burbank oil field, Osage County, Oklahoma. . . . Flood expected to recover 3,300,000 additional barrels of oil. . . .

PIPE LINES.—Bill incorporating Mid-Continent Pipe Lines, Ltd., which plans a big-inch gas line from Alberta to Ontario and Quebec is endorsed by House of Commons committee in Ottawa. . . . Line, to cost $285,000,000, is sponsored by group of Canadian business men, mostly from Toronto. . . . ¶Trans Mountain resumes work on 718-mile crude line from Edmonton to Vancouver. . . . Completion scheduled this fall. . . . ¶Hearing scheduled this week on Permian Basin's application for permit to build 163-mile big-inch gas system. . . . Plan envisions unusual gas-exchange and delivery agreement with El Paso Natural Gas Co. and Northern Natural Gas Co. . . .

IMPORTS.—T.I.P.R.O. drafts three-point program aimed at controlling influx on foreign oil. . . . Resolutions provide for (1) investigation of importing firms' taxes with view to possibly demanding an increase, (2) examination of Texas market-demand statute to determine if statute is responsible for "surrender of our market," and for (3) call upon PAD to conduct study of effect of imports on domestic producer and make appropriate recommendations. . . .



BOOSTER STATION of El Paso Natural Gas Co. which handles residue gas from the Tex Harvey gasoline plant. El Paso now is taking about 60,000,000 cu. ft. daily of Spraberry gas and will complete additional facilities by May 1 to handle another 30,000,000 cu. ft. It now has pending before the Federal Power Commission an application for an 800-mile 30-in. line originating in the trend which would enable it to handle an additional 200,000,000 cu. ft. of gas. These could be completed by next January 1 if an FPC permit were granted soon. Together with the Permian basin line, it would provide an outlet for about 500,000,000 cu. ft. of Spraberry gas daily.

Spraberry Shut In

Some operations continuing under court restraining order, but gas flaring is halted in huge West Texas trend area

Ted A. Armstrong

THE sprawling Spraberry Trend Area field, spread over five West Texas counties and encompassing nearly half a million productive acres, was almost completely shut in last week.

Ernest O. Thompson, chairman of the Texas Railroad Commission, which issued the shutdown order to halt waste of gas in the field, estimated that more than 80 per cent of all producing operations had been stopped and declared that "absolutely all gas" still being produced in the field is being utilized.

Only operations being continued were those of operators who obtained a last-minute District Court restraining order giving them 22 days of grace before their application for an injunction against the Railroad Commission is heard.

These included two gasoline plants, from which no gas is being flared, and a considerable number of wells connected to those plants. The shutdown order became effective at 7 a.m., April 1.

Involved in the action was an oil production of about 82,000 bbl. daily on a calendar-day basis and a gas production estimated at 280,000,000 cu. ft. daily. Earlier testimony before the commission had indicated that 220,000,000 cu. ft. of gas was being flared, either as casinghead gas in the field or after processing in gasoline plants.

Exceptions granted . . . Immediately before the order was scheduled to go into effect, Austin District Judge Charles O. Betts restrained the commission from halting operations of the Tex Harvey gasoline plant, the Benedum gasoline plant of Texas Gas Products Corp., and several operators whose wells are connected to them.

The Railroad Commission also modified immediately its shutdown order to permit production of sufficient gas for lease use and for drilling operations.

"It was not the intention of the commission," the modification order said, "that such drilling and development be stopped due to the lack of sufficient amounts of gas nor . . . to deprive persons living in various operators' field camps the necessary amounts of gas to be used as domestic camp fuel, but . . . rather to eliminate the wasteful operating practice of flaring enormous amounts of casinghead gas. . ."

However, the new order said, any oil produced will be deducted from well allowables after the field is reopened.

In his March 31 ruling, Judge Betts said there was "no question" in his mind but that the commission has the authority to shut in wells producing gas which is flared, whether in the field or at processing plants.

Imbibition exception? . . . Thompson indicated that another modification to the shutdown order might be issued if it is sought by Atlantic Refining Co. in order to continue its water-imbibition experiment in Driver field.

"We have power to make allowances for special cases," Thompson told The Oil and Gas Journal. If Atlantic makes "proper appearance," he said, an exception probably will be granted.

Involved is Atlantic's novel experiment of a new medium of secondary recovery which has been in operation since November. It involves water injection under the theory that the reservoir rock will soak up, or imbibe, the water which, in turn, will displace the oil.

Atlantic officials were expected to ask for exemptions for a cluster of producing wells in two or three sections of Driver field surrounding their three water-input wells.

A shutdown of this operation, an Atlantic spokesman said, could destroy the value of the project and possibly require a new start on the experiment. It had been estimated earlier that more than a year might be required to obtain conclusive results as to the effectiveness of the new method.

"If we should quit now, we have no idea what would happen to the water already injected, and if we kept on injecting water without being able to produce the oil, we wouldn't know what to expect, either," an Atlantic official said.

Industry outlook . . . The shutdown order came as a surprise to many operators in the field, although some action had been expected eventually because of the great volume of gas being flared.

Operators were not in agreement on the effects of the shutdown. Some sided with the Railroad Commission in its view that the shutdown actually would mean more production and income in the long run by providing means for recovering the liquids from the casing-

head gas and for selling the residue gas, without any loss of recoverable oil.

Many operators, however, leaned toward the view that the order will play havoc with marketing arrangements, will disrupt supply commitments, will result in lawsuits, and might even cause a loss in ultimate recovery from the reservoir. Temporary financial reverses by those companies with shut-in production seemed inescapable.

Commission position . . . In Austin, Thompson described the closing in of the huge field as a "great victory" for conservation in Texas.

He took the view that the shutdown was necessary in order to get the operating companies and individuals to solve the flaring problem. Thompson said that "if we gave them a year" in which to build plants and lay lines for handling the gas, the problem still would probably not be solved.

In San Angelo, Elmer C. Simpson, deputy district supervisor for the commission, agreed there would be a "temporary economic problem" but said commission figures show that if flaring were allowed to continue 2 years a total of 195,786,000,000 cu. ft. of gas would be lost. "The value of that gas at 10 cents per thousand cubic feet, would be $19,578,600," Simpson said.

Effect on state . . . The shutdown was ordered at a time when Texas output already was being cut back sharply under the state's market-demand statute to prevent overproduction. Loss of the Spraberry oil, thus, was not expected to affect greatly the state's total production.

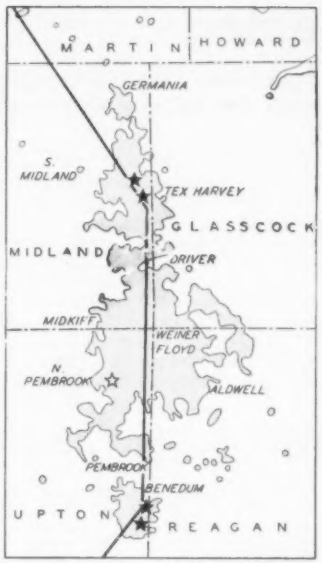
Also, the order was made effective on the same date that Fort Chadbourne field, in Coke and Runnels County, was scheduled to return to production after having been shut in for more than a year pending construction of gas-handling facilities.

R. S. Calvert, Texas comptroller, said Spraberry's withdrawal from the production picture would not affect Texas' long-term oil-income outlook.

"If the market demands more Texas oil," he said in Austin, "the Railroad Commission can provide it from the fields outside Spraberry," since market demand, and not conditions in a single field, determine the state's total production.

The May allowable for the state is scheduled to be set at a hearing in San Angelo April 17.

Reason for flaring . . . Spraberry is a high gas-oil ratio field, and production experience in the relatively new area has shown that the ratios begin to climb after a year to 18 months of production. Many wells already are past the commission's 2,000:1 ceiling on oil wells and have become statutory gas wells.



GASOLINE PLANTS handling Spraberry gas are shown by solid stars. Open star is the Pembrook plant of Phillips now under construction. Solid line represents the proposed Permian basin line, which would take 125,000,000 cu. ft. daily from the trend in 1954 and 200,000,000 cu. ft. in 1955, if the project is approved by the Federal Power Commission.

Construction of gasoline plants and pipe lines to move the gas to markets has not kept pace with drilling operations. At present there are four gasoline plants processing Spraberry gas and one under construction (see map).

From top to bottom on the map the solid stars represent these plants:

. . . Tex Harvey Gasoline Plant, Inc., which has been processing about 30,000,000 cu. ft. of gas daily and extracting 90,000 gal. of liquid products. This plant is continuing operation under the district court restraining order but at a reduced operating rate. Those operators whose wells were connected to the plant and who petitioned with the company for a restraining order were allowed to continue operations. It is expected that other operators also connected will file petitions and will be allowed to resume operations. In the meantime, the plant will operate at a throughput of about 15,000,000 cu. ft. daily.

. . . Phillips Petroleum Co.'s Spraberry plant, shut down because of lack of a pipe-line outlet for the residue gas. This plant had been processing about 25,000,000 cu. ft. daily and extracting about 80,000 gal. of products.

. . . Texas Gas Products Corp., which was allowed to continue processing Spraberry gas. This plant, located in the Benedum area, handles about 57,000,000 cu. ft. of Spraberry gas, in addition to gas from Benedum's Fusselman and Ellenburger horizons. Of the Spraberry gas, 50,000,000 cu. ft. daily is processed in remote absorbers in the Weiner Floyd area and the remainder is processed in the Benedum plant from Benedum's Spraberry production. All residue gas is delivered to El Paso Natural Gas Co., according to John T. Oxley, Texas Gas Products president.

The plant now under construction is that being built by Phillips in the Pembrook area. Scheduled for completion in August, it will handle "all gas available to it," according to a company spokesman, and will be "expanded as the need develops."

It is expected to be January 1, 1954, before sufficient pipe-line facilities are available to handle all Spraberry gas, according to testimony before the Railroad Commission March 17. The biggest line now planned for the area, that of Permian basin (see map) has not yet been given a permit for construction by the Federal Power Commission. The FPC is scheduled to begin a hearing on Permian's application this week (see page 62).

In its order the commission said that operators' testimony shows that processing facilities are now available to handle 150,000,000 cu. ft. per day, but that pipe-line outlets are such that only 60,000,000 cu. ft. of residue gas can be utilized.

By May 1, it said, an estimated 92,500,000 cu. ft. could be utilized, and that by next January 1 a total of 417,000,000 cu. ft. of Spraberry gas could be processed and diverted to "lawful and beneficial use."

Shackled giant . . . Total investment in the Spraberry trend has been estimated by George P. Bunn, manager of the natural-gasoline department of Phillips Petroleum Co., at $310 million, not including camps, roads, automotive equipment, and other items.

Bunn breaks down his estimate like this: Gas-gathering and processing facilities, $57.5 million, not including facilities for handling residue gas; drilling and equipping wells, $237.5 million; crude-oil gathering lines and handling facilities, $15 million.

The first commercial oil completion was made in February 1949. By the end of 1950 there were about 100 wells, and rapid development thereafter boosted the total to 1,200 at the beginning of 1952 and 2,200 wells on January 1 of this year. Cumulative production at the beginning of 1953 was 44,270,000 bbl.

Gas Pact Revealed

El Paso Natural, Northern Natural, Permian Pipeline negotiate unusual gas exchange and delivery agreement

Paul Reed

OMAHA.—The 163-mile system which Permian Basin Pipeline Co. proposes to build this year would function in connection with gas-exchange and delivery arrangements involving Permian, El Paso Natural Gas Co., and Northern Natural Gas Co. Permian is an affiliate of Northern Natural.

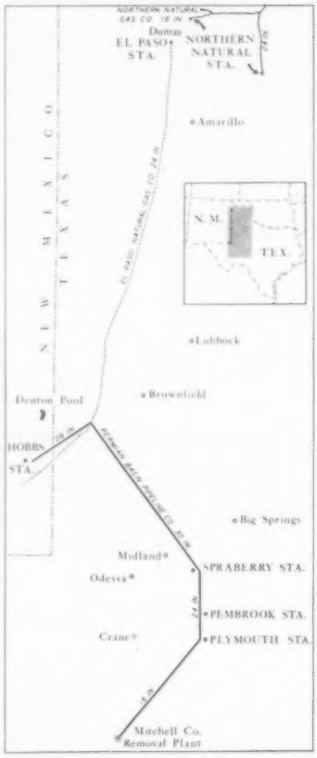
The Permian system would deliver 300,000,000 cu. ft. of gas daily from New Mexico and West Texas fields into El Paso Natural's 24-in. line at connections in Yoakum County, Texas. In turn, El Paso Natural would deliver an equivalent volume to Permian at El Paso Natural's Dumas station, 203 miles to the north in the Texas Panhandle, where the gas would be made available to Northern Natural.

The Federal Power Commission starts consolidated hearings April 6 in Washington, D. C., to consider applications of the three companies to spend $111,678,000 to construct 592 miles of line and other facilities.

Permian system . . . Construction of Permian's 163-mile, $42,530,000 system would start after pipe is available May 28. It would be completed December 1, if FPC authorization is procured in time. Expenditure for construction in the first year would be $38,135,000. The remaining $4,395,000 to complete plant and station facilities would be spent the second year.

The Permian system would deliver to the El Paso Natural at the proposed Plains compressor station in southern Yoakum County. El Paso Natural's 203-mile, 24-in. line from the Plains station to the Dumas station will be leased by Permian for 35 years. For its services and the use of its facilities in making gas available to Permian at Dumas, El Paso Natural would receive 2 cents per M.c.f. for the gas delivered in the exchange arrangement.

During the first year of operation, when a maximum of 200,000,000 cu. ft. would be exchanged between Permian and El Paso Natural, it is believed that a southward flow of gas would continue from Dumas through El Paso Natural's 24-in. El Paso Natural is expected to have sufficient gas available in the Panhandle-Hugoton area for deliveries of up to 200,000,000 cu. ft. daily for the Permian and Northern Natural exchange schedules. In the second year, when gas exchange is stepped up to the rate of 300,000,000 cu. ft. daily, the gas flow might be reversed to go northward from Plains to Dumas.



PROPOSED SYSTEM of Permian Basin Pipeline Co. which would deliver gas to El Paso Natural Gas Co. in exchange for equivalent volumes available for Permian at Dumas. Permian proposes to build sulfur, gasoline, and dehydration plants at Hobbs Station. The Permian line would connect with the Spraberry gasoline plant of Phillips Petroleum Co., and Phillips' Pembrook plant now under construction. Permian also would build a carbon dioxide removal plant at Mitchell.

Facilities to be constructed for the Permian Basin company's project will include pipe lines estimated to cost $13,658,000, four compressor stations to cost $14,755,000, and other facilities to cost $14,117,000.

The 163 miles of transmission lines will consist of 14 miles of 16-in. between the Plymouth and Pembrook stations, Upton County; 20 miles of 24-in. between the Pembrook and Spraberry stations, Midland County; 94 miles of 30-in. from Spraberry Station to Wasson Station, Gaines County; 3 miles of 30-in. at the measuring station near connection with El Paso Natural, and 32 miles of 26-in. for measuring station at Dumas.

Compressor stations . . . The four compressor stations will be equipped with 42 compressor units with a total of 55,440 hp. for the first year's operation. They will be located as follows: Plymouth, 5 units, 6,600 hp.; Pembrook, 14 units, 18,480 hp.; Spraberry, 19 units, 25,080 hp.; Hobbs, 4 units, 5,280 hp. In the second year, compressor units will be added as follows: Plymouth, 1,400 hp.; Pembrook, 5,400 hp.; Spraberry, 3,960 hp.; and Hobbs, 1,320 hp.

Since the present proposal for utilizing the El Paso Natural 24-in. line to Dumas will eliminate the need for Permian to build a 245-mile, 30-in. line, the latter company has been able to reduce the estimated cost of the project from $58,180,000 to $42,530,000.

Permian Basin Pipeline Co. is headed by W. D. Gay, president. Northern Natural owns 51 per cent of the outstanding voting securities of Permian and is directing the engineering of Permian's project through a management contract. Company headquarters is at 2223 Dodge Street, Omaha, Neb.

El Paso Natural proposes to build compressing, measuring, and regulating facilities estimated to cost $2,900,000. The Plains compressor station would be equipped with 11,000 compressor horsepower.

Northern Natural proposes to lay a 30-in. line from El Paso Natural's Dumas station to Northern's existing Sunray compressor station. The consolidated hearings starting this week before FPC include consideration of Northern Natural's $66,248,000 expansion program involving the building of 429 miles of main line and installation of 62,400 compressor horsepower, plus branch lines.

Gas-Tax Ruling Appealed

AUSTIN.—The third round in the battle over Texas' beleaguered natural-gas gathering tax began last week when pipe-line companies appealed to the Texas Supreme Court.

The appeal was taken at the last possible moment after the Third Court of Civil Appeals in Austin had upheld the tax early in February *(The Oil and Gas Journal, February 9, page 74)*, thereby upsetting an earlier verdict by the District Court in Austin that the tax was unconstitutional.

The case was taken to the Supreme Court by Panhandle Eastern Pipeline Co., Michigan-Wisconsin Pipe Line Co.,

and Amarillo Oil Co. The companies maintain that the tax is an illegal burden on interstate commerce. They filed identical 67-page briefs.

These three companies and others are paying the tax under protest. So far, the state now has collected more than $13,000,000 in protested payments. These funds are frozen until the legality of the tax is finally decided. The levy went into effect in September 1951.

Biggest Lease Sale Set

WINDOW ROCK, Ariz.—Leases on more than 528,000 acres of land in the Four Corners area in Arizona and Utah will be offered bidders here April 21 in the biggest oil and gas lease sale ever held by the United States Indian Service.

Leases will be up for bid on 214 tracts averaging about 2,500 acres. Allan G. Harper, area director for the Navajo-Hopi Indian reservations, estimated that the sale would bring the Navajo Tribe a cash bonus of about $3,000,000 plus annual rental payments of $650,000.

The lease sale is the first on lands on the Arizona side of the reservation.

Repressuring Plan Outlined

AUSTIN.—Union Sulphur & Oil Corp. outlined plans before the Texas Railroad Commission last week for a gas-injection program which the company says would eliminate gas flaring in Cree-Sykes and Cree-Sykes East fields in Runnels County, Texas, and result in the recovery of 2,861,000 bbl. of additional oil.

Gas would be injected into the Upper Gardner and Lower Gardner zones of Cree-Sykes field and in the Upper Gardner zone of Cree-Sykes East field. Union Sulphur & Oil estimated that the program would eliminate the flaring of about 15,000,000 to 20,000,000 cu. ft. of gas daily, which would be taken by a new processing plant to be completed in the field by June 1. Union Sulphur & Oil will be plant operator.

Oil production, the company estimated, would be increased by gas injection from a primary recovery of 12,166,000 bbl. to an ultimate figure total of 15,031,000 bbl.

The program would involve injection of about 300,000 cu. ft. of gas daily and use of about one well in four for injection. There are now 192 wells in the proposed repressuring area.

ROCKY MOUNTAIN

A.A.P.G. Meet Set

McCollum to set keynote at conclave April 23-24

CASPER, Wyo. — L. F. McCollum, president of Continental Oil Co., will deliver the keynote address at the annual meeting of the Rocky Mountain section of the American Association of Petroleum Geologists here April 23-24.

Other speakers will include: Horace D. Thomas, Wyoming state geologist; Alex Clark, president of the Rocky Mountain section of the A.A.P.G.; and John Emery Adams, The California Co., Midland, Tex., A.A.P.G. president.

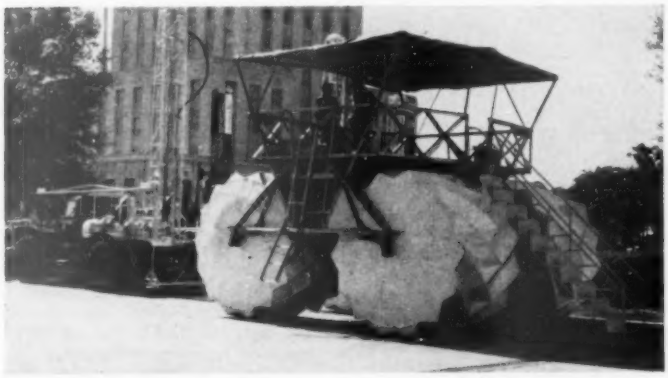
Technical papers will include:

"Structural Development of the Four Corners Region," Paul Umbach, consulting geologist and vice president of the section; "Pre-Triassic Stratigraphy of the Four Corners Region," Professor Wengerd, Four Corners Geological Society; "Western Margin of the Rocky Mountain Geosyncline in the Great Basin," W. L. Stokes, professor, University of Utah; "Problems of Carboniferous Stratigraphy Related to the Oquirrh Basin," Prof. J. Stewart Williams, Utah State Agricultural College.

"Present Knowledge of the Paleozoic Geologic History of the Denver Basin and Adjacent Parts of Western Nebraska and Northwestern Kansas," Dr. Eugene C. Reed, Nebraska Geological Survey; "The Geologic History of Southeastern Colorado and Adjacent Areas," John Maher, U. S. Geological Survey; "Phosphoria Facies Changes in the Big Horn Basin, Wyoming," Dr. John R. Fanshawe, consulting geologist; "Dating of Uppermost Cretaceous and Tertiary Crustal Movements in Wyoming," David Love, U. S. Geological Survey; "Ash Creek Field, Sheridan County, Wyoming," J. W. Reinhart, Shell Oil Co.

"Manderson, an Oil and Gas Discovery in Wyoming"; "Search for Radioactive Minerals in the Rocky Mountain Region," V. E. McKelvey, U. S. Geological Survey; "Middle Montana Tectonics," Prof. Fred S. Honkala, Montana State University; "Ordovician in the Williston Basin," Paul Lewis, Billings Geological Service; "Silurian in the Williston Basin," M. T. Rader; "Devonian in the Williston Basin," Andrew D. Baille; "Mississippian in the Williston Basin."

"Pine Unit Area and Duck Creek Area, Montana," Shell Oil Co. geologist; "Glendive Area, Montana," Ken Parsons, Williston Oil & Gas Co.; "Poplar Area, Montana," G. M. Fedderson, Murphy Corp.; "Beaver Lodge-Tioga Area, North Dakota," K. W. Roth, Amerada Petroleum Corp.; "Pincher Creek Field, Alberta," C. G. Strachan, Gulf Oil Corp., Tulsa; "Regional Geology of the Williston Basin in Saskatchewan and Manitoba," Robert Bishop, Sohio Oil Co.; "Stratigraphy of the Williston Basin in Saskatchewan," Sohio Oil Co. geologist; "Comments on the Geology of Saskatchewan and Manitoba," E. G. Robinson; "Jurassic of the Williston Basin," Dr. Donald Towse, University of North Dakota; and "Cretaceous Sediments of the Williston Basin," Dr. John Paul Gries, South Dakota School of Mines.



Aluminum Wheels Featured on New Marsh Buggy

Latest thing for working in the swamp lands along the Louisiana coast was displayed at the recent meeting in Houston of the American Association of Petroleum Geologists, the Society of Exploration Geophysicists, and the Society of Economic Paleontologists and Mineralogists. The huge wheels are made of sheet aluminum and are designed to provide both traction and buoyancy. Size of the wheels may be judged by the relative height of the men on the floor.

Pilot Flood Getting Results

CUT BANK, Mont.—A pilot waterflood project initiated December 31, 1952, on 640 acres in Cut Bank field has increased production in the test area appreciably, according to spokesmen for The Texas Co., unit operator.

Texaco is joined in the project by Union Oil Co. of California, Phillips Petroleum Co., and Ada Oil Co. Results of the pilot flood, Texaco said, so far are encouraging though they cannot as yet be termed conclusive.

Water is being injected into the Cut Bank sand through each of four converted oil wells at a rate of 200 bbl. daily and at a pressure of about 1,200 psi. To date no water has shown up in any of the producing oil wells. Water for injection is pumped from the Madison limestone.

Fracturing Answers Near

Tests should prove whether or not hydraulic fracturing will interfere with subsequent water floods, Texans told

Henry D. Ralph

WICHITA FALLS, Tex.—Tests now being started should soon settle the controversial question of whether or not hydraulic fracturing of an oil formation will interfere with subsequent water flooding of the field, it was agreed by two speakers at the annual meeting of the North Texas Oil and Gas Association here March 28.

Water floods are now being started in several pools in North Texas in which some or all of the wells have been fractured. Tom E. Morton, Dallas, division engineer of Halliburton Oil Well Cementing Co., said it was his honest opinion that fracturing is beneficial to water flooding and would not cause harmful channeling.

He based this opinion on evidence that hydraulic fracturing creates more than one fissure per treatment, the fractures are not all horizontal but often make vertical fractures, and gas and oil enter the fractures at other points besides the apex.

Opposing view . . . A less optimistic view was expressed by Dr. Maynard M. Stephens, Wichita Falls partner in Ryder Scott Co., water-flood engineers.

While agreeing that current flood tests may soon answer the question, Stephens pointed out that high pressures used in water flooding sometimes cause fracturing around input wells which results in undesirable channeling of flood water through the formation.

This exchange of opinions came during questioning after Morton had delivered a paper on hydraulic fracturing experiences and Stephens had talked on the proper use of cores in planning a water-flood operation.

Developments in fracturing . . . In the 4 years since hydraulic fracturing was introduced to the oil industry, Morton said, several thousand wells have been treated and surveys show that three out of four have responded in production increases. During this period many variations on the original technique have been developed, particularly in the fluid used to carry the sand grains or propping agent into the fractures.

The use of a viscous oil, either crude or refined, in place of the gelled hydrocarbon originally used has given good results in many places, and in North Texas particularly there is widespread use of formation-produced crude as the fracturing fluid, he said. Many operators believe that this crude is more easily cleaned out of the fractures and is less likely to cause loss of permeability.

Experiments have proved that the increased production is due to actual fracturing and parting of the formation rather than to the erosive action of the sand grains as was once surmised, he reported. The fact that fracturing occurs with less pressure than that theoretically required to lift the overburden, he explained, is because it has been found that in many cases only enough pressure is needed to compact the looser sands above and below the producing formation.

Large volumes of sand per gallon of fluid also give good results in many formations, but this requires an extremely viscous fluid to keep the sand in suspension and is very hard on the pumps. Morton said there are many theories and calculations as to how far fractures travel into the formation but there are so many variables that it is impossible at this time to make any general conclusions.

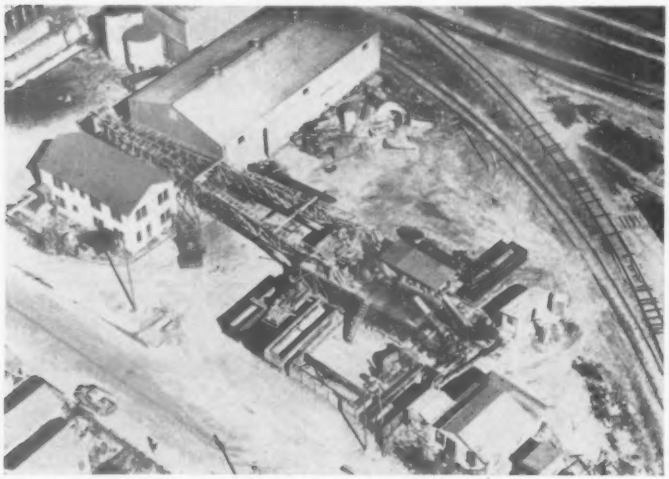
Formation knowledge . . . Stephens' paper was based primarily on the point that water-flooding technique is so complicated and varies so greatly from field to field that success or failure may depend on the amount of knowledge of the formation obtained before the flooding begins.

Cores are the eyes of the engineer and are like an X-ray to a surgeon, he said. He recommended chip coring as the most economical means of obtaining a large number of cores and also because this method produces cores which are not long exposed to drilling mud and so yield more accurate data as to the fluid content of the actual sand formation conditions.

Adequate study of sufficient cores prior to flooding, Stephens said, can give the engineer information on:

. . . Permeability of the sand, both vertical and horizontal;

. . . Percentage of sand and shale in the sand formation;



Close Figuring Was Required to Spud in This Well

Few oil pools are left untapped because of surface obstacles. In spite of the problems involved on this town lot in McAllen, Tex., the drilling contractor found a way to rig up. With mathematical precision, the 133-ft. mast was assembled between two buildings. The draw works, mud pumps, tanks, and auxiliary equipment were arranged in a tight square to minimize the amount of space required. The city of McAllen sits above a high-pressure gas-distillate field. (Photo courtesy Dresser Equipment Co.)

... **Porosity of the sand;**

... **Oil content,** both total and an estimate of the recoverable oil;

... **Water content;**

... **Grain size** of the sand particles;

... **Clay content** of the formation;

... **Compatibility** of the formation with water.

The wettability, or whether the sand pores are predominantly wet by oil or by water.

When a large number of cores from a property are available they give information as to the best spacing of water wells, proper locations of the producing well within each five-spot, the degree of sand lensing from well to well, the quantity of oil which will be recovered, and the relationship of one sand zone to another throughout the area.

Stephens gave a number of case histories of water floods to show how proper use of core information brought greater oil recovery and how inadequate information caused losses in certain floods.

He warned against the "wildcatters' approach" to water flooding, saying that it is a delicate operation in which shortcuts are risky, and one in which the technique must be varied from field to field in order to best suit the individual conditions.

Missed opportunity . . . Secondary recovery ought to be called "missed opportunity recovery," in the opinion of D. V. Carter, chief petroleum engineer of Magnolia Petroleum Co., Dallas.

"The fact that steps must be taken to recover oil which otherwise would not be obtained from the reservoir is prima facie evidence that the field in question has not been properly operated," he told the N.T.O.G.A.

In most cases, he said, it is more profitable to start fluid-injection operations as soon as possible after discovery that the reservoir is in need of such assistance.

Carter made five observations on fluid-injection operations which have come out of Magnolia's experience:

... **The relative** cost of reserves obtained from secondary-recovery operations varies about as much as the cost of primary reserves, and both range from financial losses to very profitable ventures.

... **A considerable amount of capital** is frequently necessary to develop a project properly, a fact not always recognized by those venturing into it for the first time.

... **A considerable period of time** usually elapses between investment and tangible financial return, thus calling for adequate financing and "a certain amount of financial fortitude."

... **The more work is done** in the field of fluid injection, the more it is realized how little the industry does know and how much more remains to discover and understand.

... **Many projects** having the same apparent geological and engineering conditions sometimes yield widely different results, even to the extent that a likely looking project may border on financial failure.

However, Carter concluded, engineering and science can be depended upon to bring about improvements which will result in a considerable reduction in both investment and operating costs in fluid injection. This, he said, is one of the most pressing needs at the present time.

Plea for more unitization . . . A plea for greater use of unitization was made to the association by R. M. Chan, first vice president of Magnolia Petroleum Co., Dallas, who said:

"It is my opinion that unitization is probably the most significant development in the oil and gas-producing industry in recent years. Some day I look for lessees and royalty owners to join in a unit immediately after the first well is completed in a field.

"It would present an opportunity to develop the field on a scientific basis, placing the wells where needed to effect the greatest recovery based on formation contours, sand conditions, and producibility studies. Such a project would eliminate the duplication and waste caused by competitive drilling; it would allow study and initiation of secondary-recovery mechanisms early in the life of the field; it would point to the maximum recovery of hydrocarbons at the lowest possible cost; and would constitute a vital contribution to the conservation of our minerals.

"From the standpoint of a small operator with limited acreage, unitization offers a means whereby he can be assured of his share of the returns without high competitive costs. In addition, by paying only his proportionate share of the total cost, he assures access to plant and operational facilities as well as to skilled engineering study and counsel."

Criticism answered . . . Chan answered some of the criticisms of unitization by explaining that in Texas it is entirely voluntary but will be approved by the Railroad Commission on proof that a unit plan of operation will eliminate waste and bring increased recovery of hydrocarbons. He pointed out that such a plan must not contain field rules, must not limit production, must not provide for cooperative marketing, must protect the rights of all parties whether they sign up or not, and must not be a combination in restraint of trade.

Taxes, Imports Hit

North Texas group also talks secondary recovery

WICHITA FALLS.—Taxes, imports, and secondary recovery were the principal topics of discussion at the twenty-third annual meeting of the North Texas Oil and Gas Association here March 28.

New officers installed were Eugene B. Clark of Clark Drilling Co., president; Charles N. Prothro of Perkins-Prothro, first vice president; and D. C. Norwood of Norwood Drilling Co., second vice president. All are of Wichita Falls. Fred Schmann was reelected executive vice president.

The petroleum industry, as a group which has demonstrated its willingness in the past to pay a large share of the cost of state governmental services, should be given a holiday on tax increases at least until it has passed its present crisis of oversupply, depressed drilling rates, and costs which are out of line with current market prices, the group was told by Charles E. Simons, executive vice president of the Texas Mid-Continent Oil and Gas Association, Dallas.

Oil taxes high . . . Simons said that in Texas the oil and gas industry is already contributing 67 per cent of the taxes on business and property, and he criticized present legislative pressure in the state for further increases in oil taxes.

On the other hand, the association was warned by State Senator George Moffett of Chillicothe that it is a safe bet that there will be some increase in the taxes on the petroleum industry by this session of the legislature because of the great pressure for increases in the salaries of schoolteachers and other state employes and the extreme need for additional revenue for state operations. He declined to predict what form an increased tax may take.

One fact of great importance to the oil industry, Senator Moffett said, is that an increasing number of Texans realize that the condition of the industry has a direct bearing on the condition of the state's treasury, and that a cut in allowable production means that other taxes must be raised to make up the loss in production taxes. He said that this realization ultimately will operate to the advantage of the industry

in giving it fair treatment in taxes and operating regulations, and at present it is building up general popular resentment against the large imports of foreign oil which are blamed for recent reductions in Texas oil production.

Imports may cause oversupply . . . If imports continue at their present rate this country will be faced with a dangerous oversupply of oil and the domestic industry may be driven to extreme measures in retaliation, the association was warned by Ernest O. Thompson, chairman of the Texas Railroad Commission.

This danger was also stressed by Robert F. Windfohr, of Fort Worth, president of the Texas Mid-Continent Oil and Gas Association, but he urged the industry to avoid hasty action and to first attempt to secure a voluntary reduction in imports through cooperation of the importers.

This approach was endorsed by Dr. Robert E. Wilson, chairman of the board of Standard Oil Co. (Ind.), Chicago, one of the importing companies. In a speech outlining a program whereby business and industry can reverse the swing toward socialism and gain popular support for business and the principles of free enterprise, Wilson injected an endorsement of Windfohr's plea for solving the import problem within the industry instead of asking the federal Government for help through legislation of administrative action.

Tubular Goods Tight

Difficulty in obtaining pipe expected for months

WICHITA FALLS.—Operators may have a rough time obtaining tubular goods for 3 to 6 months after June 30 but should be able to drill about 46,500 wells during the year, the North Texas Oil and Gas Association was told by Emmett A. Vaughey, director of the production division of the Petroleum Administration for Defense.

All controls over civilian uses of steel will end June 30, but that will not end operators' troubles with oil-country tubular goods, Vaughey warned. Instead, pipe and casing will be harder to obtain for several months, though the situation should be much improved by the end of the year.

During 1954 and 1955 there should be adequate supplies to permit the completion of 50,000 wells per year in this country plus reasonable amounts for export. Under present economic incentives, Vaughey said, the estimate of 50,000 wells per year is more realistic than higher goals set earlier by PAD.

PAD's allocations of tubular goods during the second quarter were higher than ever before and should take care of about 95 per cent of normal needs on the basis of PAD standards, Vaughey explained. This is because mill production will be 40,000 tons, or 10 per cent, higher than during the first quarter and PAD drew out another 42,000 tons from field stocks.

Mill output up . . . During the third quarter, mill production will be 50,000 tons above the second quarter but this will be offset by the facts that the drilling rate is normally higher at that season, field stocks will have been drawn down, Canadian and foreign operators will be increasing their efforts to obtain more tubular goods in this country, and many operators will attempt to build up and balance their inventories.

The situation will begin to improve during the third quarter, Vaughey predicted. Then production of tubular goods will be 70,000 tons higher than during the second quarter and the adequacy of supply should be so apparent that operators can be expected to stop building inventories.

Outlook bright . . . For the year as a whole, Vaughey said, production of new tubular goods should be sufficient to drill 37,000 domestic wells, or 80 per cent of the estimated 46,500 wells scheduled for 1953. If the remaining 9,500 wells are to be completed, it will have to be with second-hand and line pipe and with pipe made from foreign and conversion steel, Vaughey said.

Regular mill production should supply enough tubular goods during 1954 and 1955 for 47,000 domestic wells annually with an adequate supply left for foreign needs. Vaughey said that normal use of second-hand pipe should permit completion of an additional 3,000 wells per year.

Drive Against Imports

T.I.P.R.O.'s three-point program seeks to help stem tide of foreign oil; committee may ask higher taxes on importers

Henry D. Ralph

SAN ANTONIO.—A three-point campaign against imports of foreign oil was mapped by the Texas Independent Producers and Royalty Owners Association at its annual meeting here March 30-31.

Most surprising was the adoption of a resolution which appears to point the way to repeal of the Texas market-demand statute under which the state's production has been curtailed. The reasoning was that the resulting flood of domestic output would lower crude prices so as to undersell foreign competitors and regain the United States market for domestic producers.

What the resolution actually does is to ask the Texas Legislature to examine the interpretation and application of the statute by the Texas Railroad Commission "to determine whether or not the statute is responsible for this surrender of our market, and if so, to take proper remedial action."

Few want statute repealed . . . Except for a few rabid free-enterprisers it was evident that few of the independent producers really want the market-demand statute repealed. They complained that other oil-producing states have similar laws but apply them in such a way that production is not cut as severely as in Texas. They suggested that the Texas Railroad Commission should not consider imports when estimating market demand.

Suspension of the market-demand formula, it was pointed out, would increase Texas allowables by an amount estimated at between 600,000 and 1,000,000 bbl. per day.

PAD study asked . . . A second resolution called on the Petroleum Administration for Defense "to conduct a study of the effect of imports upon the domestic oil industry as it affects the security of the United States, and make such recommendations as may seem appropriate in the light of such study to the end that quotas may be established under which imports may be kept at such level as to supplement domestic production."

The reasoning here was that PAD could obtain antitrust clearance from the Department of Justice to get the importing companies to agree to hold their imports to levels approved by federal agencies as reasonable and proper.

Importers' taxes questioned . . . The third approach, also couched in veiled language, directed the T.I.P.R.O. executive committee to make a study of the taxes paid by the importers of foreign crude "and take whatever appropriate action is indicated to more equitably distribute our tax burden."

The preamble of this resolution asserted that Texas is losing $100,000 per day in tax revenue as the result of a decrease of 467,000 bbl. per day in oil production during the past 4 months,

and that domestic oil pays taxes of 50 cents per barrel while foreign oil pays only 7.8 cents per barrel. Presumably this resolution looks to a high tariff duty or special excise tax on imported oil.

These three resolutions were all that came out of an all-day session of the imports committee which discussed every conceivable method of dealing with the imports problem. Many proposals for federal action were voted down on the plea that the oil industry is just emerging from a period of too much regulation and the independent producers should not sponsor controls which might eventually be extended and used against them.

The resolutions were adopted by the more than 350 members present after a long and heated argument.

Secretary opposes . . . The cause for less regulation rather than more was led by L. A. Douglas, of San Antonio, secretary of T.I.P.R.O., who opposed all three resolutions and asked for outright repeal of the market-demand statute and a return to complete free enterprise. Forget about price, undersell competitors, and expand markets through unlimited production, he advised.

The majority of the speakers, however, said that regulation has gone too far to permit turning the clock back, that the effects on conservation must be considered, and that domestic producers must have a high price if they are to build up the reserve capacity needed for defense. They also argued that Texas laws are not responsible for imports, and that since domestic producers must operate under regulation there must be some regulation on importers.

Iranian resolution turned down . . . The members did vote down, largely on the theory that it was none of their business, a resolution calling on the U. S. Government to embargo "stolen" Iranian oil and to refuse any assistance to the Iranian Government until it has compensated the "rightful owners" of the oil.

In taking their stand, the T.I.P.R.O. members did not follow the advice of Roy J. Turner, former governor of Oklahoma and also an oil producer. In a featured address he asked support of the position taken by the Independent Petroleum Association of America in seeking congressional legislation establishing a quota system under which varying quantities of oil imports would be assigned to the foreign producing countries and importing companies.

Turner said imports are taking $330,000,000 per year from domestic producers and importing companies have shown that they will not curtail unless forced to by law, so federal legislation has become necessary.

Unitization resolution . . . A broad statement of association policy on various aspects of the oil and gas business was adopted by the membership after a hot debate on compulsory unitization. After some modification of the original language, a resolution was adopted condemning compulsory pooling as giving undue advantage to large operators and making it difficult for small producers to stay in business. A sizable minority made a stiff fight for endorsement of unitization when enforced under safeguards for all interests involved.

New officers . . . New officers elected were M. D. Bryant, San Angelo, president; Bert Fields, Dallas, secretary; and William T. Beard, San Antonio, treasurer. Bryan W. Payne, Tyler, retiring president, becomes vice chairman ex officio. Vice presidents and executive committeemen were also elected for the various districts of the state.

Producers Warned

Rather tells T.I.P.R.O. gas industry can't operate with posted field prices if price fluctuations would result

SAN ANTONIO.—A plea for all segments of the natural-gas industry to work together for the good of all received little more than polite reception at the annual meeting of the Texas Independent Producers and Royalty Owners Association.

A set of resolutions urging changes in many practices of pipe-line companies was adopted in spite of a conciliatory address by C. P. Rather, president of Southern Natural Gas Co., Birmingham, and also president of the Independent Natural Gas Association of America.

Rather asked T.I.P.R.O. to join in his association's new public-relations campaign to educate the public on the value of natural gas as a fuel and the dangers in excessive regulation, and he

This Plant Injects Gas for Atlantic's Unusual Project

A new approach to secondary recovery resulted in construction of this Atlantic Refining Co. plant in Block 31 field of Crane County, West Texas. The plant now is injecting gas into the Devonian reservoir at a pressure in excess of 4,000 psi. as a means of sweeping reservoir oil to producing wells. It contains three 800-hp. compressors and six 880-hp. compressors. Four compressors receive gas from the field's low-pressure gathering system at about 5 psi.; three take gas from the field's high-pressure system at 105 to 125 psi.; the remaining two receive purchased gas at about 500 psi. The plant has a total discharge capacity of 35,120,000 cu. ft. per day and currently is injecting gas at a rate of 26,500,000 cu. ft. daily. Latest concepts of Atlantic's high-pressure injection process are contained in an article in this issue of the Journal beginning on page 84.

also defended in detail many of the pipe-line practices which producers are complaining about.

Rather said that field prices of gas will go up but warned that there are competitive limitations on price and that increases must be gradual because of the difficulty in getting regulatory commissions to increase consumer rates. Average field prices actually have risen rapidly since the war, he said, and about 60 per cent of the $200,000,000 in rate-increase applications filed by transmission companies during the past 2 years represents reimbursement for higher gas costs.

Rather said the gas industry could not operate under posted field prices if that implied the possibility of frequent changes in price and possible loss of connections because investors would not finance a line without assurance of a long-term supply of gas at a price known in advance.

Pricing resolution adopted . . . T.I.P.R.O. adopted a resolution asking for "uniform posted field prices for natural gas" but in the discussion it was brought out that the main objective is "published and nondiscriminatory" prices. The producers complained that several different prices often prevail for gas from the same field or even the same well, and they felt that publication of prices would gradually lead to uniform prices within a field. It was made clear that a state-wide uniform price without regard to location or quality was not the objective.

The resolution also asked for ratable taking of gas as between leases, producers, and fields in the state. It was brought out that in special cases the Railroad Commission may now enforce ratable take within a field but that legislation is needed to prevent a pipe line from discriminating among several fields where it has connections. One remedy suggested was monthly nominations for gas purchases.

T.I.P.R.O. also asked legislation to establish minimum gas prices within a field when necessary to prevent waste, defined as physical rather than economic waste. This has special reference to the Texas portion of Hugoton field which, it was said, is being drained rapidly because of the much higher minimum prices fixed by Oklahoma and Kansas in their portions of this field.

Hits fixed minimum prices . . . Rather warned against fixed minimum prices because of differences in gas quality, pressure, location, availability, and contract terms, and asked that producers offer some revisions in contract terms when asking for a renegotiation of contract prices. He also warned that a government which fixes minimum prices may also fix maximum prices.

Some concessions were made in T.I.P.R.O.'s position on gas taxes. Resolutions as originally introduced called on the legislature to impose new taxes on gas pipe lines. As adopted, they asked that no additional taxes be placed on producers until it is determined that all other segments of the gas industry are paying their fair share. A resolution asking taxes on refined and natural gasoline was voted down.

Rather had pointed out that all taxes eventually raise prices and are paid by the consumer and he asked an end to the game of tossing the tax burden from one branch of the industry to another. He also complained about taxes designed to curtail exports from the state. But T.I.P.R.O. endorsed a suggestion for a possible tax on purchase contracts which tie up gas reserves for a long period of time. Both Rather and T.I.P.R.O. agreed in opposing a pending proposal to impose a horsepower tax on gas compressor.

Agreement on regulation . . . There was agreement in opposing federal regulation of production and gathering of natural gas in any way, but the T.I.P.R.O. resolution on this subject added an expression against the expansion of underground-storage capacity beyond that needed to compensate for seasonal variations.

Rather assured the producers that gas storage near points of consumption is so expensive that they could forget their fear that it might lead to a transfer of Texas reserves to other states to be held for higher prices.

Two States Join Compact

OKLAHOMA CITY. — Two more states have joined the Interstate Oil Compact Commission as associate members, the I.O.C.C. announced here last week.

Bills authorizing entry of Washington and Nevada into the compact were signed by Governor Langlie, of Washington, and Russell, of Nevada.

Counting these two states, the compact now has four associate members —states without oil or gas production at present but with prospects. Total membership of the compact consists of 25 states.

New Lubricant Developed

LINDEN, N. J.—A synthetic lubricant designed to stand up under the high speeds and extreme temperatures encountered in new-type jet aircraft engines was announced here April 2 by Standard Oil Development Co.

S.O.D. said the synthetic oil is the first product approved under U. S. military specification MIL-L-7808 for synthetic jet-engine lubricants. More than 10,000 hours of ground and flight-engine tests have shown that it can meet the problem of lubricating highly stressed gears and bearings at high speeds and over a temperature range from below −65° F. to over 450° F.

The new lubricant, composed chiefly of esters, was developed by S.O.D. and affiliated research laboratories in England. It is being manufactured in this country by Esso Standard Oil Co. at several locations which were not disclosed for security reasons.

Industry Briefs

WICHITA.—The Kansas Corporation Commission has set the state's daily crude-oil production allowable for April at 310,000 bbl.—5,000 bbl. daily less than permissible production in March. This was the second consecutive monthly reduction. The March allowable was slashed 10,000 bbl. daily.

AUSTIN.—The Texas Railroad Commission has postponed to April 27 the hearing on proposed amendments to field rules for the new SACROC Unit, which comprises the old Kelley-Snyder and part of Diamond "M" fields of Scurry County, West Texas. Postponement also was ordered on an application by Sunray Oil Corp. and Magnolia Petroleum Corp. for permission to begin an injection project in the unitized area. The deadline for operators not yet in the unit to join was extended by the commission from September 10 to November 1.

LANSING, Mich.—Michigan's Governor Williams has signed into law legislation authorizing the state's Conservation Commission to grant easements permitting Lakehead Pipeline Co. to lay pipe across the state. The line is an extension of the big Interprovincial crude line which now carries Alberta crude to Superior, Wis. It will cross the upper peninsula, cross the Straits of Mackinac, and extend across northeastern Michigan to Sarnia, Ont., crossing the international boundary at Port Huron.

MEMPHIS.—A bill has been introduced in the Tennessee Legislature which provides for a cash bonus of $100,000 to the operator bringing in the first oil or gas discovery within 5 years after the bill becomes law. The discovery well must produce at least 50 bbl. of oil or 25,000,000 cu. ft. of gas daily for 60 days to win the bonus.

Heavy-Crude Dilemma

Recent price adjustments in California widen discrepancy between postings for heavy, light crudes; no relief seen

D. H. Stormont

LOS ANGELES. — California operators whose production is comprised solely of low-gravity crudes may be in for some trying times, according to all present indications.

For one thing the relationship of heavy-crude prices to light-crude prices is out of line with that of several years back. The February general price rise, as well as the increases just before prices were frozen in 1951, tended to further distort the situation rather than correct it.

Another factor is that the ratio of heavy-crude output to light crude production is tending to climb. In January 1941, crudes under 20° gravity accounted for 21 per cent of the state's 605,000-bbl.-daily output. Last January they comprised 27 per cent of the 989,000-bbl. daily production. Of the 17,000-bbl. production increase over January 1952, heavy crudes accounted for 13,000 bbl.

This fall Canadian crudes will enter the Pacific Northwest, replacing California crudes which historically have supplied that market. Initially the line probably will operate at the rate of 120,000 bbl., possibly at as much as 150,000 bbl., daily. Its ultimate capacity is 300,000 bbl. daily. The initial rate will be more than sufficient to erase the indigenous crude shortage currently existing on the West Coast.

Finally, there is the probability of a pipe line from West Texas, made much more justifiable economically by the recent 50-cent increase in California light-crude prices. Importation of high-gravity West Texas crudes at the rate of 75,000 bbl. daily—a figure somewhere near the minimum economic capacity for such a line—would result in an oversupply of crude on the West Coast if the line is constructed in the immediate future. Heavy crudes undoubtedly would bear the burden.

Price relationship . . . The growing disparity in the past 4 years between prices paid for heavy and light crudes in California is shown by a comparison of postings in Montebello and Coalinga fields.

In Montebello, posted by Standard Oil Co. of California, prices of the low-gravity crude (14°-14.9°) have dropped 21 cents per barrel since January 1949, from $2.18 to $1.97. The price of light crude (35°-35.9°) climbed 63 cents, from $2.70 to $3.33. Coalinga prices, as posted by Union Oil Co. of California, are down 18 cents, from $2.08 to $1.90, while light crude is up 78 cents, from $2.46 to $3.24.

How one Long Beach independent refiner, Century Oil Co., feels about the situation is evidenced by its postings of 10 cents per barrel less than Standard's for heavy crude and about 17 cents more for light crude. Terming its postings "realistic," Sol Alexander, Century crude-purchasing agent, said "we need the high-gravity crude and are willing to pay for it."

Supply-demand situation . . . Last year imports of foreign and domestic petroleum into District 5 averaged 79,000 bbl. daily, of which 41,000 bbl. was crude oil, according to Bureau of Mines figures. Total stocks during this period increased 13,629,000 bbl. (37,000 bbl. daily), of which 4,700,000 bbl. (12,000 bbl. daily) was in fuel-oil inventories. Stocks of crude were up 2,480,000 bbl., a gain of 7,000 bbl. daily.

Thus, last year California production failed to meet demand by about 42,000 bbl. daily. However, because the military was unable to obtain the supplies on the West Coast, it shifted about 60,000 bbl. of direct military demand to Gulf Coast refineries. In round figures, therefore, potential demand for crude and refined products in District V exceeded production by 100,000 bbl. daily.

When the 120,000 to 150,000 bbl. daily of Canadian crude enters the picture next fall, total petroleum supplies will exceed demand, even if the 60,000 bbl. required by the military is once more shifted to the West Coast. Under present postings this shift is not likely to occur. Gulf Coast gasoline reportedly can now be laid down in Los Angeles Harbor at ½ cent under the West Coast refinery price.

Also by next fall, production of the Elk Hills shallow pool probably will be stepped up about 15,000 bbl. daily.

Settlement of the federal-state tidelands ownership dispute would cause development of California's offshore reserves to be resumed. New production from this source would not be felt for a year or more but unquestionably would add to the state's output.

Posted prices of Los Angeles basin crudes now are approximately 90 cents above those of light, sweet West Texas crudes. Whether or not the currently proposed West Texas line is started this year, continuation of this price condition is expected to result in con-

Geologists Look for Familiar Areas on Huge Map

What may well be the world's biggest map is this air-photo mosaic of the southern United States from Southeast New Mexico to Florida. The layout took a large section of the wall space and half the floor area in front of it in the exhibition hall at the recent Houston joint meeting of the American Association of Petroleum Geologists, the Society of Exploration Geophysicists, and the Society of Economic Paleontologists and Mineralogists. Paper shoes were provided spectators desiring a close inspection of portions of the extensive and unbroken photographic coverage. The map was constructed by Edgar Tobin Aerial Surveys.

struction of such a line sooner or later.

All signs thus point to greater availability of light crudes, a continuing excessive study of residuals, and little chance for improvement in the price relationship of California heavy crudes.

Well-Survey Conference Set

LOS ANGELES.—Engineering and production representatives of major oil companies actively engaged in drilling operations in California are being invited by Schlumberger Well Surveying Corp. to attend its new Interpretation Conference here April 14-17.

This is the first such conference ever held, according to M. E. Loy, acting area manager for Schlumberger in Los Angeles. Its purpose, Loy said, is to bring the California industry the latest and most complete information on proper interpretation of well-surveying data and results and to help engineers and production men to take full advantage of this information in their drilling and production operations.

Tax Privileges Granted

WASHINGTON. — Certificates for accelerated amortization have been granted by the office of defense mobilization for a $12,376,000 petroleum pipe line and a $5,667,600 refinery in the Pacific Northwest.

The pipe line will be constructed by Texas Pipe Line Co., Houston, with quick write off of 40 per cent of $1,138,000 and 25 per cent of $11,108,711.

The refinery, to be built at Tacoma, Wash., by Pacific Oil & Refining Co., was granted 65 per cent of $4,288,000, 45 per cent of $1,304,000, and 15 per cent of $75,500.

MID-CONTINENT

New Flood Planned

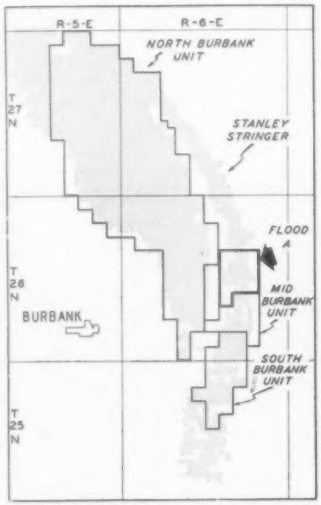
Kewanee begins drilling program preparatory to flooding another area of the Stanley Stringer in Burbank oil field

Joseph A. Kornfeld

SHIDLER, Okla.—The second of a series of unitized water-flood projects for the Stanley stringer sector of the 25,000-acre Burbank area of Osage County will be placed in operation by July 15.

The Stanley stringer is a sand bar paralleling the main Burbank field. It lies 1 mile east of the main field at the southern end but joins into a common lens at the northern tip (see map). The stringer is 7 miles long and has a maximum width of ¾ mile.

The first water-flood project in the Stanley stringer is the Mid-Burbank Unit, where water was introduced during November 1951. During the past 19 years, a successful gas-repressuring program has been conducted in several sectors of the stringer and the adjoining North and South Burbank fields *(see The Oil and Gas Journal, November 22, 1951, and April 19, 1951, page 132).*



Un't formation . . . The new secondary-recovery project, designated as Flood "A," comprises 1,600 acres of Kewanee leases in Sections 14, 15, 22, and 23-26n-6e.

The unit was formed officially on March 1 by Kewanee and a blanket oil mining lease was entered into with the Osage Tribe of Indians headed by Paul Pitts, principal chief.

Flood benefits . . . Primary recovery and prior gas injection have recovered 3,387,482 bbl. of oil. There are 34 producing oil wells with a daily production of 232 bbl.

By water flooding Kewanee expects to recover an additional 3,300,000 bbl. of oil. The water flood is expected to boost the daily oil rate to 1,500 bbl. by July 1954.

Kewanee estimates that more than 26 million barrels of water will be required to conduct the flooding program during the next 10 years. Initially, the maximum water requirements are calculated to be 9,000 bbl. per day. About one-half of the volume of water would be obtained from producing oil wells and the remainder will be acquired from extraneous sources.

Injection pattern . . . A modified 20-acre, five-spot input-well pattern is under development. Infill drilling for both oil and injection wells now in progress will result in a total of 59 wells by July, including 31 oil wells and 28 input wells in operation.

To bring the area under flood to full density, Kewanee plans to drill 17 new wells; 9 of these will be input wells, 8 will be oil wells.

Workover program . . . Since the flood-pattern design involves the use of old wells, an extensive workover program is under way to convert pattern locations to injection. However, the completion method employed originally on these wells presented a problem: the wells had been equipped with a string of 6⅝-in. casing set 100 ft. above the oil sand and a 5½-in. o.d. liner was run to the top of the Burbank sand and was not cemented.

The upper part of the Burbank sand is comprised of a highly fractured and shaly sand zone. Injection of water into these old oil wells under the original setting would result in ineffective dispension of flood waters which would result in a premature water cut and low displacement efficiency.

Kewanee engineers decided to pull these old liners, run new liners to the saturated part of the main Burbank sand body and apply a squeeze-cement job. In addition to excluding this fractured, shaly zone, engineers also shut off effectively by this method gas cap or depleted zones of high permeability.

To date Kewanee has experienced no breakthroughs in the Mid-Burbank unit as a result of following this practice.

Drilling new wells . . . Two 4,000-ft. contract rotary drilling rigs are drilling input and infill oil wells. After the sand is cored, an electric log is run and a string of 5½-in. pipe is set and cemented on top of the pay. The well is then completed for either an input or oil well depending upon pattern location.

Central power units are now being replaced with individual 25-hp. pumping units at each well.

Tidelands Bill Voted

House passes measure; vote in Senate due this month

WASHINGTON. — Final action on legislation restoring their offshore oil lands to the coastal states is expected to come before the end of this month.

The bill sent to the House provided the machinery for administration of the Continental Shelf beyond state boundaries and gave the states policing powers and authority to collect severance and production taxes, while the Senate bill reserves to the federal Government all jurisdiction and control.

In passing the bill by a vote of 285 to 108 on April 1, however, the House knocked out the tax provision. This was the only change made by the House, which rejected amendments to apply royalties from submerged lands to educational and national defense purchases; limit the bill to states already in the union, which would leave out Hawaii and Alaska when they are admitted; allow the federal Government to keep the impounded payments from lessees on the submerged lands; reserve a one-tenth interest in mineral rights for the education of certain Indians, and strip the bill of all provisions relating to the Continental Shelf.

So far as return of the lands within the historic borders of the states is concerned there is no difference between House and Senate bills. But while the House measure would permit the states to impose severance or production taxes and to police and enforce their conservation laws in the Continental Shelf area beyond their borders, the Senate bill reserves to the Government all jurisdiction and control.

Separate legislation planned . . . The Senate Interior Committee, which wrote the legislation in the form suggested by Atty. Gen. Herbert Brownell's recommendations that the oil and other resources in the outer Continental Shelf be held solely by the federal Government, plans to draft separate legislation to authorize its development. Whether the states will be given a voice in the administration of the area seaward of their boundaries will be determined in that bill, but the Louisiana and Texas senators may seek to speed up the decision by moving to include the House provisions in the bill now pending in the Senate.

The difference of opinion over the disposition of the outer Continental Shelf stems less from a desire on the part of the administration to gain control of the oil than from fears that recognition of the states' rights in the area might lead to international complications. The seaward limits of the states coincide with the national boundaries and any implication that the states have titles beyond their present boundaries might lead to assumptions that the United States was extending its limits.

The idea of the Senate version of the legislation is to give the United States jurisdiction and control of the area but

WATCHING WASHINGTON

Bertram F. Linz

Jet-Fuel Needs Jump

Military oil requirements for the fiscal year which begins July 1 are expected to be 20 per cent greater than for this year.

On a product-by-product basis, the increases will range from 10 to 100 per cent, the latter for jet fuels which now have become a major item.

Just what the military requirements will be will depend upon the appropriations granted by Congress. It will be a couple of months before the Defense Department knows just how much money it will get for the coming fiscal year.

While jet-fuel requirements are expected to double, aviation gasoline needs are expected to expand only about 10 per cent on the whole with a somewhat greater increase in Grade 115/145.

Over-all requirements of the military for the last 6 months of 1952 were 70,847,000 bbl. of gasoline, diesel oil, jet fuel, and other products.

Except for aviation gasoline, which is going to remain a problem through the rest of this year at least, Petroleum Administration officials are confident military needs will be met. Substantial readjustment of refinery schedules and operations, and installation of additional facilities is expected to be necessary to provide the large volume of jet fuel which is foreseen.

Wanted: Judicial Opinion

The Federal Trade Commission has asked the Chicago federal Court of Appeals to review its latest order in the Standard Oil Co. (Ind.) "good faith" case, a somewhat unusual procedure since normally the respondents in FTC cases are the parties who go to the courts.

The commission issued its original order against Standard in 1946 holding there had been violation of the Robinson-Patman Act in the lower prices quoted to certain customers but not made available to all in the same class. The Chicago appellate court affirmed the FTC order with slight modifications but the Supreme Court reversed both the commission and the lower court. It held that a seller may successfully defend against a charge of price discrimination by showing he was meeting in good faith a price offered his customer by a competitor even in the face of affirmative proof of injury to competition at the retail level.

The case was remanded to the commission, which last January issued modified findings holding that Standard had failed to justify its price discriminations by showing that its lower prices were in fact granted in good faith to meet equally low prices of its competitors.

Its new order, now before the Chicago court for consideration, directed the company to cease and desist selling gasoline of like grade and quality in interstate commerce (1) to one retailer at a price lower than the price charged a competing retailer and (2) to a retailer at a price known to be higher than the price at which the gasoline is being sold to a competing retailer by a wholesaler-customer of the respondent who receives a price less than the direct retailer-customer.

Through the whole period of the Standard Oil proceedings the commission has been split on the issue of good faith. Two members dissented from the findings on which the latest order was based, and one member dissented from the decision to ask the Chicago court to review it.

In the view of Commissioner Lowell Mason, long the sole Republican on the commission, there is no authority for the court to intervene in the proceedings now.

Mason pointed out that the power of judicial review invoked originally by Standard was exhausted when the Supreme Court acted.

to avoid interference with the freedom of the seas or of the air above the seas, it was explained by the committee chairman, Senator Cordon of Oregon.

Extension Asked

McKay outlines reasons for keeping PAD in business

WASHINGTON.—Continuation after June 30 of the Petroleum Administration for Defense and other emergency agencies under his administration was recommended to the Senate Banking Committee April 1 by Interior Secretary Douglas McKay.

At the same time, McKay told the committee that practically all provisions of the present Defense Production Act, with the exception of price and wage controls, should be continued. He further suggested that in view of the uncertainty as to what problems, if any, might arise in the future with respect to natural-gas supplies the present prohibition against federal limitations on expansion of service in the states which certify they have undertaken that responsibility should be repealed.

Of most importance from the viewpoint of PAD and his other defense agencies, the secretary said, are continuance of the authority for the Government to obtain the services of skilled executives and technicians from industry without payment of compensation; continuance of the authority to encourage voluntary agreements among business men to further the purposes of the defense program; and extension of the present authority for the imposition of materials controls.

"There is no indication of an effective change in the international situation that permits abandoning or relaxing the development and maintenance of mobilization readiness programs now under way," McKay declared.

McKay explained that while full material control authority is felt necessary, it is planned only to exercise allocations to protect military programs and defense supporting activities such as the aviation-gasoline program.

Alkylation Plan

New-type contract provides for federal plant financing

WASHINGTON. — Government financing of new alkylation plants is being offered refiners where private capital or borrowed funds are not available, in an effort to step up the production of aviation gasoline.

The Armed Services Petroleum Purchasing Agency announced last week that the House appropriations armed services subcommittee had approved a new facilities contract under which the contractor will retain legal title to the facility but will hold it for the benefit of the Government, which will recoup the funds advanced in part through savings in alkylate and aviation gasoline prices and ultimately through disposition of the plant.

The savings in prices would come through exclusion of depreciation and interest on investment and a reduced allowance for profit, management and contingency.

In the event the Government did not require the product of such a plant the contractor would be permitted to operate it for his own account, paying the Government a use-charge based on the investment, but whenever the plant was not operated the Government would reimburse the refiner for the costs of standby maintenance.

The new plan will not supplant the original alkylation facilities underwriting plan which affords greater earnings to the refiner in sales prices and in accelerated tax amortization and provides other advantages to the refiner, ASPPA explained.

ASPPA is inviting applications for contracts under either plan, to be submitted direct or through the refining division of the Petroleum Administration for Defense.

CANADA

New Gas Line Planned

OTTAWA, Ont.—A House of Commons committee has endorsed a bill here incorporating Mid-Continent Pipelines, Ltd., which is planning to lay a big-inch gas line from Alberta gas fields to markets in Ontario and Quebec by an All-Canadian route.

The $285,000,000 system generally would extend from Alberta to Winnipeg and thence north of the Great Lakes. It would reportedly serve all communities along the route and such large centers as Toronto, Ottawa, and Montreal.

The incorporation measure now goes back to the House of Commons for final approval. It already has been passed by the Senate.

Mid-Continent Pipelines is sponsored by a group of Canadian business men, mostly from Toronto. Fish Engineering Co., Houston, has agreed to handle engineering and design if the project is approved by the Canadian Board of Transport Commissioners and export of gas from Alberta is endorsed by the Alberta Conservation Board.

Oil-Sands Plant on Block

EDMONTON, Alta.—The Alberta government intends to sell its oil-sands-extraction pilot plant at Bitumont in northeastern Alberta.

J. L. Robinson, minister of industries and labor, said the government has received offers from private companies, interested in developing the oil sands and carrying extraction experiments further, for the lease or sale of the plant.

He said the plant will go on the auction block not later than early summer and it will be sold to the highest bidder.

"As far as a pilot plant is concerned it has served its purpose," he added. "It was set up to prove a method of extracting oil from the sands in that area. It has done that."

The plant separated the oil from the sands on the hot-water flotation principle. A report for the government by S. M. Blair, Toronto geologist, claimed that it had been proved that oil could be separated from the sands on a commercial basis.

Line Work Resumed

VANCOUVER, B. C.—Construction has been resumed on Trans Mountain Oil Pipe Line Co.'s 718-mile crude trunk line from Edmonton, Alta., to Vancouver.

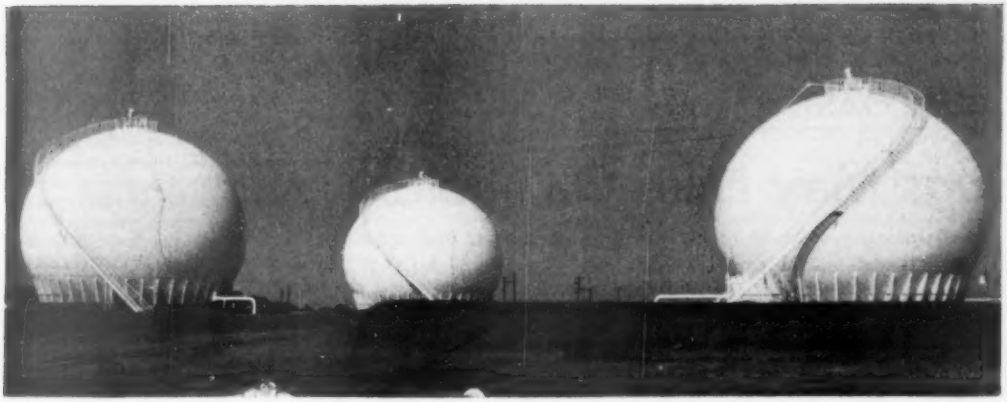
Mannix, Ltd., has one spread working west of Kamloops, B. C., and is forming another to work east of the community.

Anderson International Constructors, Ltd., Edmonton, has started clearing work on a 53-mile stretch between Acheson, Alta., and the Pembina River.

Comstock Midwestern, Ltd., has two spreads clearing right-of-way, one in the Edson, Alta., region, the other near Hope, B. C. A third spread will begin work in the Blue River, B. C., area on June 1.

Work is progressing on tankage and pump stations. Construction is under way on several short lines connecting the main line with refineries and the new tanker terminal at Westridge in Vancouver. Missouri Valley Canadian, Ltd., has contracts to lay 2½ miles of 10-in. from Burnaby tank farm on the eastern terminus of the line to Shell Oil Co.'s Shellburn refinery, 4 miles of 12-in. from Burnaby tank farm to the Imperial Oil, Ltd., refinery at Ioco, and 2 miles of 24-in. from the tank

WORKING STORAGE for NATURAL GASOLINE



4,000 barrels of natural gasoline pass through these Hortonspheroids* daily

The Shell Pipe Line Corporation's Cushing, Oklahoma terminal is using three Hortonspheroids as natural gasoline working tanks. The natural gasoline handled through them is produced in the Elk City field and transferred to Cushing in batches via Shell Pipe Line Corporation's 158-mile 10-in. line from Elk City. At Cushing, it is injected into passing crude oil streams for further transportation by pipe line to Wood River, Illinois.

An approximate uniform movement of 4,000 bbls. of natural gasoline passes through these Hortonspheroids daily. Pressure storage is required to prevent boiling at the volatility and temperatures involved. Hortonspheroids have proved themselves especially well adapted to this method of storing and handling natural gasoline.

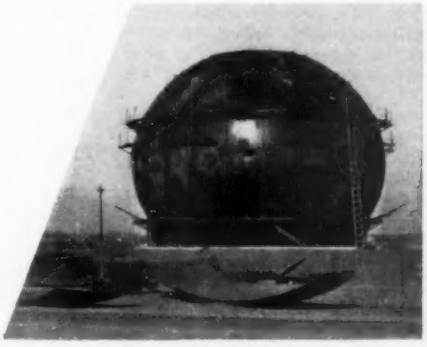
Distinctive of shape and clean lined, Hortonspheroids are designed to resist internal pressures resulting from volatility and temperature variations. Contents cannot escape as long as the internal pressure does not exceed the pressure relief valve setting.

Hortonspheroids are built in capacities from 2,000 to 120,000 bbls. with working pressures from 2½ to 100 lbs. per sq. in. For further information, estimates or quotations on Hortonspheroids or other Horton structures for the petroleum industry, write our nearest office. There is no obligation on your part.

Trade Mark Registered in U. S. Patent Office

Top: Three 20,000-bbl. Hortonspheroids built for Shell Oil Company at Cushing, Oklahoma. They are 64 ft. 1 in. diam. by 54 ft. 3 in. and are designed to operate at a working pressure of 38 lbs. per sq. in.

Below: One of the Hortonspheroids at Cushing during construction. The fabricated plates were pickled and painted before shipment from the shop. After erection was completed, spots where shop paint had become abraded were cleaned, spot coated and final coats of paint applied immediately.



CHICAGO BRIDGE & IRON COMPANY

Plants in BIRMINGHAM, CHICAGO, SALT LAKE CITY and GREENVILLE, PENNSYLVANIA

Atlanta, 3.....2154 Healey Bldg.
Birmingham, 1.....1536 North 50th St.
Boston, 10.....1025—201 Devonshire St.
Chicago, 4.....2128 McCormick Bldg.
Cleveland, 15.....2204 Midland Bldg.
Detroit, 26.....1514 Lafayette Bldg.
Havana.....402 Abreu Bldg.
Houston, 2.....2119 C & I Life Bldg.
Los Angeles, 17....1523 General Petroleum Bldg.
New York, 6.....3347—165 Broadway Bldg.
Philadelphia, 3....1615-1700 Walnut Street Bldg.
San Francisco, 4.....1554—200 Bush St.
Seattle, 1.....1325 Henry Bldg.
Tulsa, 3.....1606 Hunt Bldg.

REPRESENTATIVES AND LICENSEES

Horton Steel Works, Limited, Fort Erie, Ontario, Canada
Ateliers et Chantiers de la Seine Maritime, Paris, France
Constructions Metalliques de Provence, Arles-sur-Rhone, France
Chicago Bridge & Iron Company, Ltd., Apartado 1348, Caracas, Venezuela
Comprimo N.V., Amsterdam—O, Netherlands
Compagnia Tecnica Industrie Petroli, Rome, Italy
Whessoe, Limited, Darlington, England
Motherwell Bridge & Engineering Company, Limited, Motherwell, Scotland
Sociedade Chibridge de Construcoes Ltda., Av. Franklin Roosevelt, 194, Sala 704-C, Rio de Janeiro, Brazil

farm to the Westridge tanker terminal.

The $92,000,000 project is scheduled by Canadian Bechtel, Ltd., agents for Trans Mountain, to be entirely completed in August.

All major river crossings, including those of the Raser River at Port Mann and of the North Thompson River at Kamloops, have been completed. The $92,000,000 project is scheduled to be entirely completed in August and will handle initially 120,000 bbl. daily. This will be increased by July 1954 to 150,000 bbl. daily by addition of a fourth pump station. Ultimately, the big crude line will be able to handle about 300,000 bbl. daily by increasing pump stations to 14.

GULF COAST

Bugs May Hike Oil Yield

Tests using system of tiny organisms, enzymes, and food may prove new waterflood technique, Krell tells A.I.M.E.

C. Malcolm Davis

HOUSTON.—Experiments in microbiological engineering may result in the development of a new technique for increasing ultimate recovery of crude oil, according to A. H. Krell, Reliance Chemical Co., Houston.

Krell maintains that a microbiological system consisting of "bugs" (microorganisms), food, and enzymes, when injected into an oil reservoir in water as a carrying medium, will create methane and carbon dioxide. Both products would dissolve in the oil, the former raising pressure in the reservoir, the latter decreasing viscosity of the fluid.

Speaking at a recent meeting of the Houston Section of the American Institute of Mining and Metallurgical Engineers, Krell said bugs have been known to break down oil-like bodies into hydrocarbons. He feels that microbiological systems can be devised which could do this in a practical length of time.

Potentialities of a compatible microbiological system which can create considerable quantities of methane and carbon dioxide might be promising for secondary-recovery work in water flooding, Krell thinks. The produced constituents, methane and carbon dioxide, should aid oil recovery as they have in the past in other circumstances. Practical matters which must be considered in contemplating such a system include: (1) Behavior of the microbiological system at different pressure and temperature gradients, (2) its adsorptive characteristics, (3) the length of its life cycle, and (4) the effective permeability of the rock matrix.

Food for the bugs . . . It is known, Krell said, that protein and cellulosic materials are acted on by anaerobic-type organisms (live in an oxygen-less medium) to give off methane, and carbon dioxide. These materials contain carbonyl and carboxyl groups which, in turn, contain oxygen and nitrogen.

Boundary no barrier . . . Organisms exist Krell said, which may act exclusively on either side of the oxidation-reduction boundary. This boundary divides the anaerobic (oxygen-less) area from the aerobic area (oxygen). Some bugs can adapt themselves in either area. Krell said, however, that in order for activity to proceed, it is required that an enzyme system be present.

Synergism, which takes place in nature, Krell defined as "cooperative action of two or more kinds of bugs," and it often creates a combined effect which is more potent than the sum of the separate effects. For example, Krell pointed out, the teamwork of sulfur organisms on ocean bottoms can change the structure of the sulfur material. Teamwork of the bugs no doubt will be necessary in oil-recovery problems employing microbiological-engineering principles.

Symbosis, defined as the "living together in intimate association," is often found to be advantageous, Krell said. For example, the aerobic organisms use oxygen in a medium and then the anaerobic organisms become definitely "more effective" in their own environment. Flood water containing oxygen will be exhausted before the anaerobic organisms perform their job.

Geologists, biologists, chemists, and petroleum engineers are just beginning to pool their experiences in the field of microbiological engineering, Krell said, and their common objective is to get more of the oil out of each reservoir, retard fermentation of starch drilling muds, and arrest corrosion.

Background . . . Organic sediments apparently were laid down in a marine environment, Krell said. Certain of these sediments, he said, were bitumen-like. Maturation must have set in, and the deposits gradually changed over into petroleum-like materials. Younger types of sediments contain compounds of nitrogen and oxygen, while the older sediments contain compounds which contain principally oxygen and carbon —especially in the petroleum-like beds. It is believed, he said, that this evolution is brought about by microorganisms.

Both aerobic and anaerobic types of bugs, he said, exist in marine sediments. There are at least two types of microorganisms which live in an oxygenless medium. They supplement each other. Some microorganisms, Krell said, can move to either side of the oxidation-reduction potential boundary. The bugs on the negative side can work, for example, on sulfate and may be called "oxygen acceptors."

Rocks 9,000 ft. or 10,000 ft. deep are dominated by the anaerobic-type organisms, Krell said, and pressures up to 5,000 psi. are favorable for continued existence of this type of organism.

The microbiological system . . . An effective microbiological system, Krell said, contains the "right combination of bugs, food, and a good enzyme system."

"Enzyme system result from metabolic action where one group of a community breaks down materials which become food for another group during the over-all life-and-death cycles." Degradation and synthesis of matter result from the process, he said. Stability of matter in an over-all system is attained when one group of enzymes in a system is no longer available.

Krell said that petroleum "can be liberated from the oil zone by one of the many microbiological systems." Definite decrease of surface tension, decrease of viscosity of materials, and formation of methane and carbon dioxide—all occur during the operation of these systems, he said.

Of course, he pointed out, the "right positive and/or negative potential groups of bugs in the oxidation-reduction potential range would have to be employed."

Also, Krell said, the enzyme systems would have to be effective; furthermore, the microbiological system would have to be "compatible" with the rock matrix. Sandstones, dolomites, and limestones, he said, might require different microbiological systems. It is known that the bugs work at the oil-water and oil-gas interfaces.

Krell cited one microbiological system which feeds on dextrose. This system changes 87 per cent of the dextrose into methane and carbon dioxide.

MIDDLE EAST

Stepout Planned

American Independent reports 258 ft. of oil column in Neutral Zone test; 2.3-mile stepout to be drilled next

AMERICAN INDEPENDENT OIL CO. last week was preparing for a second drill-stem test of its significant Neutral Zone wildcat in the Middle East after coring 258 ft. of oil column in formations closely akin to those of Kuwait's Burgan field.

The well earlier had tested 2,400 bbl. daily after penetrating only a few feet of the First Burgan sand, topped at 3,470 ft. *(The Oil and Gas Journal, March 30, page 77).*

The company had set 7-in. casing at the oil-water contact and was preparing for selective perforation and testing. Present total depth of the well was not announced.

Location for a stepout 2.3 miles to the northwest was being prepared, and a company spokesman said the second well will be spudded in as soon as the Wafra 4, the discovery well, is completed. The second well will be located on the structure high as indicated by a seismic survey.

A company official said the Wafra 4 has all indications of being an "excellent well," adding that American Independent is confident it is "substantially in the oil business of the Middle East."

Producing formations encountered were the First Burgan sand, followed by a thin section of the Orbitolina limestone, and then the Third Burgan. The fourth Burgan sand was missing. The First Burgan was described as "much better" than the same sand in Kuwait's Burgan field.

American Independent said the 258 ft. of saturated sand was a continuous column but it was possible that the limestone section might prove to be a barrier between the two sand formations.

Shallow test considered . . . The company disclosed it is considering the use of a lighter rig to test a heavy-oil reservoir encountered up the hole at a depth believed to be about 1,700 ft. Oil from this zone began flowing after 9⅝-in. casing had been cemented at 3,000 ft. and forced its way up behind the casing at a rate of about 500 bbl. per day.

The company also said it is "exploring the possibilities" of sending one or more additional rigs to the Neutral Zone. Previous plans to follow the Wafra 4 well with another wildcat, this one to test the Arab zone in the southwest portion of the Neutral Zone, will be delayed in favor of drilling at least one or two wells to confirm the discovery, the company said.

Pacific Western Oil Co., which holds an undivided half interest in the Neutral Zone concession, has agreed to plans for the stepout well. What course American Independent, as operator for both companies will take after drilling the stepout has not yet been decided.

The discovery well is located about 20 miles from the Kuwait border and about 25 miles from the coast. It was the company's sixth well, and the first producer, in a $30,000,000 exploration program which began in 1949.

Crude Price Cut

A.I.O.C. lowers postings on Kuwait oil by 15 cents

ANGLO-IRANIAN OIL CO., LTD., last week lowered its price for Kuwait crude by 15 cents a barrel in a move to establish a new quality price differential in the Middle East.

New price for Kuwait crude is $1.50 a barrel for 31°-31.9° gravity, f.o.b. Mena-Al-Ahmadi, the Kuwait port. The lower price was effective April 1, and the reaction of other suppliers of Middle East oil was not immediately available. The main question was whether they will accept a permanent 15-cent differential for Kuwait crude based on quality or will wipe it out by making similar reductions of their own. Gulf Oil Corp., which owns the other half-share of Kuwait production, was considered certain to follow Anglo-Iranian's cut.

Going price in the Persian Gulf for several years has been $1.75 for 36°-36.9°-gravity crude, with the usual 2-cent differential. Kuwait crude thus has been priced at $1.65 for its normal 31°-31.9° gravity. It is understood that private deals and intercompany transactions have for some time recognized in price the fact that Kuwait oil is somewhat less desirable from a refining standpoint because of heavier fuel-oil yield and other factors.

Anglo-Iranian said, "The company's practice hitherto has been to sell Kuwait crude at a price adjusted to the level of postings for other Persian Gulf crudes by reference solely to the conventional gravity scale of 2 cents per barrel per degree A.P.I. The Kuwait posted price now established reflects, however, a further adjustment in recognition of the fact that as between crude oils of different origin differing in gravity to any material degree, the conventional adjustment does not necessarily preserve the true parity."

Other postings . . . Anglo-Iranian also announced its posted prices for other Middle East crudes except Qatar from which it presumably does not have any surplus for sale. These prices were $2.29 for Iraqi crude at the eastern Mediterranean and $1.75 at Fao, Persian Gulf, all of 36°-36.9° gravity. These prices are the same as those already prevailing. It was indicated the company would continue to make these public postings in the future.

Although reported to be largely recognition of price concessions already being made, Anglo-Iranian's cut in Kuwait crude undoubtedly added to the downward pressure on Middle East crude prices. It has the incidental effect of cutting the income received by the Shaikh of Kuwait, who has a 50-50 agreement with the company.

Brokers Award . . . Another bearish factor in Eastern Hemisphere oil prices was the new semiannual assessment of the time-charter tanker market on April 1, the socalled Brokers Award, by a panel of tanker brokers in London. The April 1 award was the equivalent of about U.S.M.C. minus 19 per cent, an unusually sharp drop. The award is used widely in determining transportation costs and as such enters into the Eastern Mediterranean f.o.b. crude price.

Socony Geologists in Turkey

Socony-Vacuum Oil Co., Inc., has sent a team of three geologists into Turkey to carry out preliminary reconnaissance work.

The company has obtained a reconnaissance exploration permit from the Turkish Government which authorizes survey work of this nature throughout the country. Standard Oil Co. (N. J.), recently announced plans for a similar preliminary study of Turkey's prospects, and several other large companies are reported to be interested.

The Turkish Government last year

revised its policy to open the country to private foreign oil capital, but parliamentary enactment of new petroleum legislation is necessary before full-fledged exploratory work can be undertaken.

Dukhan Well Blows Out

Well No. 35 in Dukhan field in the Persian Gulf shaikhdom of Qatar blew out and caught fire March 29. The well was still burning out of control by the middle of last week when Myron Kinley, Texas' fire-fighting specialist, left by air for the site.

Reports were that the blowout and fire which collapsed the derrick occurred when a core barrel stuck and circulation was lost. The operating company is Petroleum Development (Qatar), Ltd., an associate of Iraq Petroleum Co., Ltd.

Israeli Leases Let

Exploration rights are granted to seven groups

WITH the major international companies showing no interest, the Israeli Government last week granted exploration rights to seven independent firms and groups representing American, Canadian, Swiss, and Israeli capital.

Best known of the companies taking out licenses under the new Israeli petroleum law is Husky Oil Co., Cody, Wyo., a producing and refining company in Canada and the Rocky Mountains. Husky obtained licenses on 400,000 acres in various parts of the country.

No applications had been anticipated from the large international companies. Aside from geological considerations and the question of Israeli's oil prospects, these companies are heavily committed in the Arab states of the Middle East which are still in a state of war with Israel.

Pinhas Sapir, director of the government's development department in Jerusalem, called in the press March 29 to announce that 31 licenses had been granted, most for areas along the coast and in the Negeb and Dead Sea sections of the country. Max Ball, Washington consultant who studied Israeli geology and later helped draft the law, reported 2 years ago that these three regions along with the foothills belt of Judea are the country's "most promising."

Other lessees . . . Besides Husky, exploration licenses were granted to:

Lapidoth (Ampal Mekoroth), an American-Israeli group affiliated with Histadruth, the Israeli Federation of Labor.

Israeli Oil Prospectors Corp., Ltd., representing Israeli, Swiss, and American interests.

Jordan Exploration Co., Ltd., which was exploring west of the Dead Sea when the war interrupted its program in 1948.

New Continental Oil Co., a Canadian firm represented by Frank Kaftel.

A Canadian group including Newkirk & Co., Ltd., Minervah Mining Corp., Ltd., and Harrison & Co., Ltd.

A group represented by Gerson Brodie, consulting geologist and independent operator of Denver.

Under the Israeli law which became effective last August 31, exploration licenses give exclusive right for test drilling and to a full production lease if a discovery is made. The law provides that exploration must commence within 4 months and test drilling not later than 2 years.

EUROPE

NIGHT VIEW of the new Shell-St. Gobain chemical plant at Berre in southern France.

New Petrochem Plant

Shell, French firm open $5,600,000 facility at Berre, France, to produce variety of chemicals from propylene

THE first of several refinery-based petrochemical plants under construction in France has been officially opened at Berre near Marseilles.

The plant is owned by a joint subsidiary of Shell Francaise, the French subsidiary of the Royal Dutch-Shell group, which holds 60 per cent of the capital, and the French chemical firm, Manufactures des Glaces et Produits Chimiques de Saint Gobain, Chauny et Cirey, which has the remaining interest.

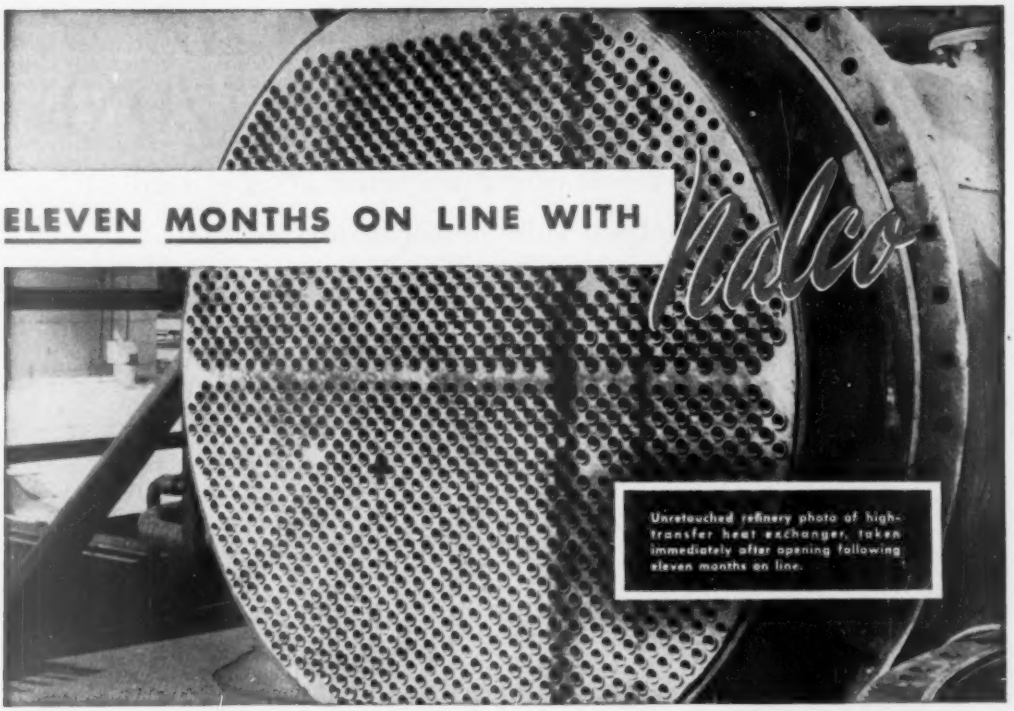
The 68,200-bbl. daily Shell refinery on the Etang de Berre about 14 miles west of Marseilles supplies propylene to the new petrochemical plant for the production of acetone and other solvents. Isopropyl alcohol and acetone are now being produced, while methyl-isobutyl-ketone, diacetone alcohol, and methyl-isobutyl-carbonol will be in production in a few months.

The new plant was built in what is considered to be a record time of 16 months, using Shell's experience in the petrochemical field in Britain, the Netherlands, and the United States. It cost the equivalent of about $5,600,000.

The plant's annual capacity of 7,500 tons of acetone and 3,000 tons of methyl-isobutyl-ketone, added to that of other plants near completion, will bring France's total production capacity to 20,000 tons of acetone annually. This output, it is said, will make the country independent of imports and will permit a foreign exchange saving of $700,000 annually. Moreover, the chemicals produced in this petroleum-based-operation will be about 30 per cent cheaper than those made from acetone by the fermentation process.

New cracking unit . . . Cie de Raffinage Shell-Berre, the refining company, has under construction at the Berre refinery a new 8,000-bbl.-daily catalytic cracking unit which is expected to be completed about the middle of this year. In addition to high-octane motor fuel, the unit will produce propane, butane, and propylene which will be supplied to the new Shell-St. Gobain chemical plant.

Other refining companies in France are participating in petrochemical proj-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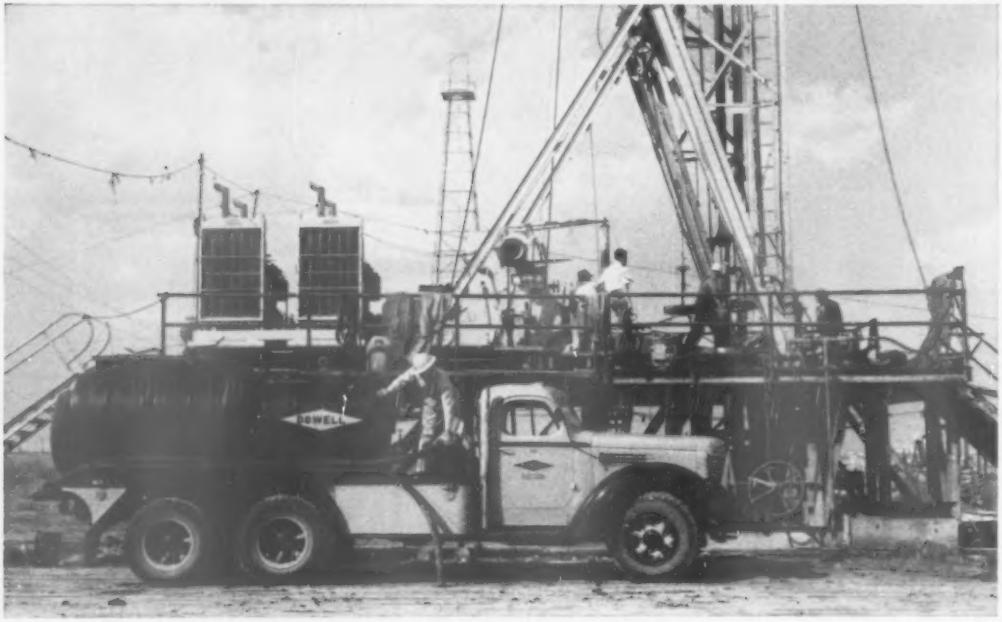
DOWELL MUD ACID OPENED UP CRITICAL ZONE

Well flowed 25 barrels of oil per hour after chemical treatment helped solve completion problem



Production suffers when the critical area of a well is blocked. Eliminating the blocking materials so that the well can flow freely often presents a major problem to oil producers.

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This is but one example. There are many others, where Dowell Mud Acid has spelled the difference between profit and loss. Results show that cement squeeze jobs are more often successful if Mud Acid is used ahead of the cement. And many operators use it to help free stuck drill pipe.

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ects elsewhere in the country. Raffineries de Petrole de l'Atlantique, a French company, is cooperating with several chemical firms in the erection of a plant in Donges in western France to produce cumene, phenol, and acetone. Raffineries de l'Atlantique operates a 33,000-bbl. daily refinery at Donges.

The Naphtachimie company, founded by Pechiney, Soc. General des Huiles de Petrole, and the chemical firm, Ets. Kuhlmann, is planning to produce ethylene oxide, glycols, glycol ethers, and ethanolamines from ethylene and isopropanol and isopropyl acetate from propylene. S.G.H.P. is the French affiliate of Anglo-Iranian Oil Co., Ltd., and operates refineries at Dunkirk in northern France and L'Avera in southern France, each of 40,000-bbl.-daily capacity.

German Test Successful

The exploratory well 3 Rot about 9 miles south of Heidelberg in the upper Rhine Valley of West Germany found production recently between depths of 2,140-2,300 ft.

The well is located on a joint-interest concession of the Germany companies, Itag and Wintershall, A. G. The structure was located by reflection seismograph. Details of the test results were not given.

Prospects for the new field Aldorf, between Bremen and Osnabrueck have been improved with the recent completion of two extension wells and one field well. All three wells are expected to be productive.

Other German exploratory developments include a successful stepout about 1½ miles northeast of the discovery well in Boostedt field near Neumuenster in Schleswig-Holstein.

FAR EAST

Third New Plant for India

A third new refinery will be built in India as a result of an agreement reached by the Indian Government wth the Caltex organization.

Caltex has committed itself to build a plant at Vishakapatnam, a ship-building center in the State of Mardas on the east coast. Initial capacity will be 50,000 tons, or the equivalent of about 10,000 bbl. daily.

Construction of the Caltex refinery will be deferred for about 2 years under the company's plans for the project. An official of the Commerce Ministry of the Indian Government said in New Delhi that work would begin early in 1955.

Standard Vacuum Oil Co. and Burmah-Shell reached agreements with India nearly a year and a half ago for new refineries near Bombay, of 25,000 and 40,000 bbl. daily capacity respectively; at that time it was reported a similar Caltex agreement would follow shortly. All these refineries will operate on Persian Gulf crude and will relieve India's almost complete dependence on imported products.

The terms of the Caltex agreement are presumed to be the same as those given Burmah - Shell and Standard-Vacuum.

A Caltex official in New York confirmed the agreement and said the plant would be built to meet the company's "increased requirement" in that market.

Shell Hikes Showa Holdings

The Royal Dutch-Shell organization has been authorized by the Japanese Foreign Investment Council to increase its holdings in Showa Oil Co. from 26 to 50 per cent.

Under its increased interest, Anglo-Saxon Petroleum Co., Ltd. (Royal Dutch-Shell) will guarantee Showa's crude supplies indefinitely instead of for 5 years as originally contracted. Credits for the importation of crude oil will be granted Showa for a 6-month period on the part of the Shell affiliate.

The arrangement also provides that Anglo-Saxon will give the Showa company all possible assistance, financial and technical, in the construction of refining facilities. The Shell representation on the Showa's board is to be increased.

Showa has two main refineries in Japan, one at Kawasaki and one at Niigata, with an aggregate capacity of about 12,000 bbl. daily.

New Dhulian Zone Found

The discovery of a new producing horizon has given new importance to Dhulian field in the Punjab of West Pakistan.

The field, first discovered in 1937, is one of four operated in the area by Attock Oil Co., Ltd. In a recent statement in London, the company reported that the new pay appears to be at least equal in extent to the former main horizon.

A third well into the new pay now is producing 250 bbl. daily of water-free oil against a high back pressure. The horizon's top is 8,260 ft., about 600 ft. below the former main producing formation. Another well, still further down flank, will be deepened to reach the new formation.

The company also reported that its Pakistan subsidiary, Pakistan Oilfields, Ltd., was drilling at 2,075 ft. on a second test well at Bains and had carried another exploratory well at Dhariala to 4,159 ft. Drilling in the latter test is to resume when heavy flows of salt water are cased off.

LATIN AMERICA

Venezuelan Strikes Reported

Several new field discoveries have been reported in Eastern and Central Venezuela in recent weeks.

Socony-Vacuum Oil Co. of Venezuela found four sands productive in its North Oscurote 1 test about 12 miles northeast of Mene Grande Oil Co.'s East Nipa field in Anzoategui State.

Unofficial reports credited the well with a combined potential of about 2,900 bbl. daily. Last year, Socony completed its Oscurote 1 wildcat in the south part of this faulted area. This was a single zone completion good for about 800 bbl. daily.

Oscurote 2 now is testing with a total depth of about 10,000 ft. The company plans to follow this with another well in the northern section. Gravity of the crude in the North Oscurote 1 ranged from around 15° up to 28° or 30°. The completed wells are shut-in awaiting construction of a pipe-line outlet.

Socony recently established its first production in the state of Guarico when it brought in the East Ruiz 1 as a moderate producer good for about 250 bbl. daily of 30°-gravity crude from a single sand. This well, which went to about 4,500 ft., is about 2½ miles east of Venezuelan Atlantic's Ruiz field and on the same trend as Ruiz and Phillips' Bella Vista field a short distance to the east.

Mene Grande's Siglo 1 wildcat, about 3½ miles south of Cantaura in Anzoategui, showed for a new field discovery. Reported potential of the well was in excess of 70 bbl. daily. Mene Grande's Flecha 1, in the Caico Seco region, also is expected to be a new field discovery.

Venezuela Cuts Output

Further substantial cuts have been made recently in Venezuelan oil production in response to market demand conditions.

Venezuela's output is understood to have dropped 130,000 bbl. daily because of sales and outlet difficulties. Venezuela has no proration system such as exists in Texas, and since storage is relatively small, production fluctuates as demand varies.

Last available figures on Venezuelan production are for the week ended March 9 when output averaged 1,706,400 bbl. daily. This compares with 1,717,100 bbl. daily in February and a 1952 average of 1,803,900 bbl. daily.

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Exploitation Chief

R. Foss directing Sunray drilling and production

ROBERT EDWIN FOSS, who was promoted last fall to a new position as vice president and manager of the exploitation department of Sunray Oil Corp. at Tulsa, is a native Californian.

Foss, 42, was transferred from Los Angeles. He now supervises drilling and producing activities through the Mid-Continent states and California.

He received a degree in mechanical engineering from California Institute of Technology in 1932 and later began his career as a rotary drilling helper in the Los Angeles area.

In 1935 he joined the old Barnsdall Oil Co. as a petroleum engineer. He was promoted to chief engineer in 1940 and general superintendent 2 years later.

He was named to the vice presidency of Barnsdall in 1945 and placed in charge of production for West Coast operations. Following the merger of Barnsdall with Sunray in July 1950, Foss became a vice president for the latter. His title was changed 2 years later to vice president and manager of the company's California operations.

Henry J. Grance, has been appointed chief production engineer in the gasoline section of the product development and product engineering department of Gulf Oil Corp., at Pittsburgh. He formerly was assistant section head of the automotive-fuels section, division of automotive engineering, at the research laboratories.

A. F. Giebel, petroleum engineer for Amerada Petroleum Corp. at Seminole, Tex., has been transferred to Bronco, Tex., as farm boss.

Robert J. Munn has been promoted from field engineer to assistant vice president and general manager for Duke Petroleum Co., Ltd.

Roy J. Tibbets has been elected chairman of the board of directors of Sinclair Pipe Line Co. **William H. Morris** was named president to succeed Tibbets. Both Tibbets and Morris will continue to maintain offices in Independence, Kans. **Robert C. Beardon,** formerly a vice president, was elected executive vice president and director. **Gerald M. Johnson,** Fort Worth, was named vice president and director in charge of crude lines, and will move to Independence.

Munehiko Mitsumatsu, chief of the engineering division of Mitsubishi Oil Co., Ltd., in Japan, and **Takeo Ijuin,** assistant superintendent of the company's Kawasaki refinery in Tokyo, are completing a 3-month tour of refinery centers in the United States. Mitsubishi is a subsidiary of Tide Water Associated Oil Co. Last week they visited the engineering offices of The Oil and Gas Journal in Tulsa. Their tour also has included San Francisco, Chicago, New York City, and Drumright, Okla., and they plan to visit Houston and Los Angeles before returning to Japan.

Dr. George E. Hinds, Houston, assistant to the manager of Continental Oil Co.'s petrochemical department, has been appointed market-development representative for the department. He will continue to make his headquarters in Houston. **James G. Hough,** superintendent of Conoco's petrochemical plant at Baltimore, has been promoted to the newly created position of superintendent of petrochemical manufacturing there. He will be responsible for manufacturing activities at both the Baltimore and Chicago petrochemical plants. **Walter Miller,** resident engineer at Baltimore, has been named to succeed Hough.

Oscar W. Morton, former vice president of Panhandle Eastern Pipe Line Co., has been appointed acting assistant deputy administrator for gas transmission and distribution operations of the Petroleum Administration for Defense. Morton, who joined PAD in March 1951 and for the past year has been director of gas operations, will succeed **Howard B. Noyes,** who is retiring after a year's service to resume his post as vice president of the Washington Gas Light Co. **G. Barrett Herr,** director of the gas facilities division since April 1952, has resigned to return to his position as superintendent of stores for Peoples Natural Gas Co., Pittsburgh.

Philip Janssen, manager of the operating department at the Dominguez, Calif., refinery of Shell Oil Co., has returned to his post after a 4-month asignment in Marseilles, France. With Shell since 1945, Janssen was sent to France to assist in the construction of a new petrochemical plant.

T. C. STAUFFER

T. C. Stauffer has been appointed to the newly created post of administrative assistant in the production department of Sun Oil Co. at Philadelphia. He formerly was manager of Sun's central production division at Evansville, Ind. **E. J. Reading,** formerly land department manager at Evansville, has succeeded Stauffer.

G. O. Howard, senior petroleum engineer for Humble Oil & Refining Co. at Tyler, Tex., has been transferred to Talco, Tex., as district petroleum engineer.

Donald D. Engle, production engineer for Midstates Oil Corp., has been transferred from Homer, La., to Tulsa.

H. F. WINHAM

H. F. Winham, former production division manager at Donaldsonville, La., for Shell Oil Co., has been named to head a new oil shipping division in the New Orleans area. Other appointments in the shipping division include: **G. H. Starrett,** division superintendent; **S. G. Wiles,** division mechanical engineer; and **A. L. Bradley,** who will head the administrative section. Named to Winham's former post is **W. H. Holleran,** formerly production superintendent in the Franklin, La., division. **W. E. Harpst,** formerly chief

PERSONALS

mechanical engineer in the Houston and New Orleans areas, has been named head of a newly created production division in the New Orleans area and will have offices in Westwego, La.

Ben F. Curtis has been appointed chief geologist for Texas Eastern Production Corp., Houston. Curtis, who joined Texas Eastern in 1951 as a district geologist, has served recently as division geologist at Shreveport. He formerly was assistant geologist for Skelly Oil Co. and district geologist for Kerr-McGee Oil Industries, Inc.

E. G. Bilderback has joined the staff of Cable Engineering, Wichita Falls, Tex., petroleum engineering firm. He formerly was associated with Magnolia Petroleum Co.'s water-flooding project in Kermit field as a mud engineer and equipment specialist.

Ralph P. Roe, engineer for Stanolind Oil & Gas Co., has been transferred from Tulsa to Fort Worth.

Jack H. Walters has been named district production superintendent for Sohio Petroleum Co. at Shreveport. He replaces **J. M. Gibson,** who was transferred to Houston to fill the newly created post of division engineer. **Jim Morris,** district geologist at Shreveport, has been transferred to Lafayette, La., to replace **Jesse George,** who has been named division geologist at Houston.

Roberto M. Giannattasio, formerly connected with the purchasing department of Yacimientos Petroliferos Fiscales in Argentina, has been placed in charge of the New York office of Empresas Nacionales de Energia, the Argentine government organization which administers coal, oil, and other fuel resources. Giannattasio, who received an engineering education in Buenos Aires, earlier was in Y.P.F.'s drilling and production organization. In New York, he replaces **Abel O. Malvestiti** and **Teobaldo R. Manrique.** Malvestiti, who has been in the United States since January 1947, for the first 4 years representing E.N.D.E.'s Gas del Estado, wil return to Buenos Aires to rejoin the gas organization. Manrique is scheduled to leave New York April 11 for Argentina where he will take up new duties with Y.P.F.

F. M. (Pete) Clingman, tool pusher for B.B.M. Drilling Co., has been transferred from Midland, Tex., to Tatum, N. M.

John S. Goodrich, formerly assistant superintendent for Magnolia Petroleum Co. at Healdton, Okla., has been appointed production superintendent for Macmillan Petroleum Corp. at Oklahoma City.

Earl B. Noble, formerly petroleum consultant for the National City Bank of New York has opened offices as a consulting geologist in Los Angeles. Prior to joining the National City Bank he was general manager for Canada for Union Oil Co. of California. He is a past president of the American Association of Petroleum Geologists.

George J. Blundun has been appointed joint chief geophysicist for Federated Petroleums, Ltd., and Home Oil Co., both operating in Alberta fields. He previously was geophysicist for Gulf Research & Development Co. and was with Northwest Seismic Surveys, Ltd.

Dr. E. E. Lyder, who recently retired as general manager of the El Segundo, Calif., refinery of Standard

DR. LYDER

DR. SHLECHTER

Oil Co. of California, has been named a consultant on refinery and petrochemical-plant engineering and operation for Bechtel Corp., San Francisco. **Dr. Nathan Shlechter** has joined Bechtel as a process design engineer in the fields of petroleum refining and petrochemistry. Dr. Shlechter's career with various engineering firms includes an extensive background in catalytic cracking and reforming.

T. Wayne Warren has joined Ethyl Corp. as supervisor of research in refinery technology at the Detroit research laboratories. He formerly was in the technical service division of Humble Oil & Refining Co. For 17 months he was on leave of absence from Humble while serving as aviation-fuels specialist for the Petroleum Administration for Defense in Washington, D. C. With Ethyl he will be associated with the expansion of research in the field of fuel technology.

C. C. Lawrence, seismic party chief for Amerada Petroleum Corp., has been transferred from Rio Vista, Calif., to Delano, Calif.

John N. Johnson has been elected vice president of Sinclair Oil & Gas Co. He also will continue as general assistant to the executive vice president, **H. B. Smith.**

A. T. Rylands, formerly division manager for Shell Oil Co. at Corpus Christi, has been named manager of the East Texas division. He succeeds **W. C. Crake,** who has been appointed chief mechanical engineer for Shell's Gulf Coast area.

Dr. Donald Mackay Morrison has been appointed manufacturing manager for Shell Oil Co. of Canada. Last year he served with the government in Ottawa as director of the Petroleum Division to deal with a threatened shortage of key materials. As manufacturing manager, he will direct refining and petrochemical expansion.

R. A. Combs, independent operator, and **David H. Hopkins,** consulting geologist, have opened joint offices in Midland, Tex. Hopkins recently resigned as district geologist in Midland for Texas Crude Co. Combs has been an independent trader the past 3½ years.

James E. Banta has been named general manager of the motor products department of Sun Oil Co., succeeding Maximilian H. Leister, who has retired. Banta formerly was assistant manager of Sun's central marketing region.

Philip E. Barber has returned from military service and resumed his duties as East Texas division civil engineer for Humble Oil & Refining Co. **C. C. Cox,** tool pusher in the London (Tex.) district, has been transferred to the Friendswood district in the same capacity. **L. E. Cezeaux** has been transferred from the Odessa to the Avoca district as tool pusher. **Ray L. Meadows,** tool pusher in the Vernon district, has been transferred to the Friendswood district and **Garland Deaton,** tool pusher, has been transferred from the North Katy to the Odessa district.

PERSONALS

Pat H. Cain, district engineer for Tennessee Production Co. at Victoria, Tex., has been transferred to Houston as a petroleum engineer.

C. P. Dimit has retired from positions as vice president of production, as director, and as a member of the executive committee of Phillips Petroleum Co. after 23 years with the firm. **L. E. Fitzjarrald** has succeeded Dimit as manager of Phillips' production department. Dimit also has served as president of Drilling Research, Inc., since its organization in 1949 and will continue his post with that firm.

C. P. DIMIT

FITZJARRALD

N. L. Hull, seismic party chief for Magnolia Petroleum Co., has been transferred from Aztec, N. M., to Dickinson, N. D.

C. J. Frazier, Jr., has been transferred from Ardmore, Okla., to Elk City, Okla., and promoted to district mechanical engineer for Shell Oil Co. **A. E. Anderson, Jr.,** exploitation engineer, has been transferred from the Houston area to Tulsa. **J. A. Wolfe, Jr.,** geologist, has been transferred from the technical services division in Houston to Colorado.

Lynn Wenstrand has been transferred from the operating-engineering section of Northern Natural Gas Co., Omaha, to the process section, where he will assist **R. B. McLaughlin,** process engineer.

C. E. Weaver, subsurface geologist for Shell Oil Co., has been transferred from North Texas to the technical services division at Houston. Other Shell changes: **H. D. Cox, Jr.,** mechanical engineer, transferred from Tulsa to the Houston area; **J. B. Davis, Jr.,** transferred from North Texas to the Colorado division as production foreman; **R. F. Nelson,** transferred from the Great Bend district to North Texas as division mechanical engineer; **M. P. Swingle,** transferred from Tulsa to North Texas as division exploitation engineer; **J. L. Tillman, Jr.,** geologist, transferred from Tulsa to the technical services division at Houston, and **J. E. Tuttle,** division exploitation engineer, transferred from Ardmore, Okla., to Colorado.

Harvey (Pete) Beasley has resigned as a geologist for Ohio Oil Co. to do consulting work at Casper, Wyo.

Tyrus Mercer has been promoted to district supervisor for Sohio Petroleum Co.'s Magnolia, Ark., area. He has been employed by the company since 1939.

Chris F. Neely has been appointed staff engineer for the Liquefied Petroleum Gas Association, Inc. He will devote his time to the organization's technical and safety activities and make his headquarters in Chicago. He joined the staff of Oil Insurance Association, Tulsa, in 1949 and for 2 years served as field engineer inspecting oil refineries and chemical and gasoline plants. Since 1951 he has been an engineer and chemical consultant for Marsh & McLennan, Chicago insurance firm.

W. W. Simpson, Skelly Oil Co., has been elected president of the Dakota Petroleum Club, Bismarck, N. D., for 1953. Other officers are: **R. C. Frawley,** Sinclair Oil & Gas Co., vice president; **Clark Crawford,** Oil Properties Corp., secretary; and **Rex Tarr,** Cities Service Oil Co., treasurer.

T. C. Powell has been appointed district exploration superintendent for the southeastern exploration division of The California Co. at Jackson, Miss. **R. D. White** has been named to the newly created position of assistant chief geologist, and will have headquarters in New Orleans. **S. W. Tolten** has been named to succeed White as division exploration superintendent of the southeastern division.

Eugene B. Clark, E. B. Clark Drilling Co., has been elected president of the North Texas Oil and Gas Association. Other officers include: **Charles N. Protho,** Perkins-Protho Co., first vice president, and **D. C. Norwood,** Norwood Drilling Co., second vice president. **Fred Sehmann** was reelected executive vice president.

DEATHS

Howard H. Lowrie, 79, formerly a member of the board of directors of Quaker State Oil Refining Corp., died March 25 in Oil City, Pa. He joined Quaker State Oil Co. when it was organized in 1925 and was assistant secretary and treasurer until the company was consolidated with Quaker State Oil Refining Corp. in 1931. At that time he was named a member of the board of directors in charge of shipments of products. He retired in September 1952.

George E. Burton, 72, Gainesville, Tex., consulting geologist for Sun Oil Co., died March 26 while visiting his son in Seguin, Tex. He retired from active duty with the company in 1951.

Rex Cooper Gale, 55, Brentwood, Calif., president of G & M Oil Co. the past 14 years, died recently.

Neal William Love, 58, Jenks, Okla., oil driller, died at his home March 25.

Louis Leander Metzger, 76, who retired about 20 years ago as a contractor in Muskogee, Okla., oil fields, died March 27 in a Tulsa hospital. He came to the Muskogee area in 1912 and was associated with the old O.P.R. Production Corp., which later was purchased by Pure Oil Co.

G. Clint Wood, 83, Wichita Falls, Tex., who played a major role in developing Electra and Burkburnett fields, died in Mineral Wells, Tex., March 27. He also was instrumental in developing fields in Stephens County and had holdings near Tyler, Tex., and Corpus Christi. He was one of the organizers of the old Humble Oil Co. in 1911.

A. Gordon DeMont, 57, director of Imperial Oil, Ltd., died recently at Toronto, Ont. He was a native of Nova Scotia and joined Imperial in 1919 as a warehouse agent at Sydney, Australia. He was named general sales manager in 1947.

Ben Hollandsworth, 63, superintendent for Ohio Oil Co., died March 24 at Bakersfield, Calif.

Fred P. Ford, 80, who had oil holdings in Oklahoma, died of a heart attack in Tulsa March 31.

Which to Use—"I" Type or "M" Type...

ESTIMATED RECOVERIES FOR UNIVERSITY BLOCK 31 FIELD COMPARISON OF HIGH-PRESSURE GAS INJECTION (I AND M CASES) WITH WATER FLOODING (TABLE 1)

	Method of production			
			High-pressure gas injection	
Factor—	Solution gas drive	Water injection	Type I 3,500	Type M 4,000
Sweep-out pattern efficiency (ultimate)		*95	*77	*73
Factor for channeling, etc.		0.85	0.8	0.8
Fraction of volume swept		81	61	58
Unit displacement efficiency (ultimate)		50	69	90
Per cent oil in place recovered	25	40	42	52

The last two columns of this table give the estimated recovery when the pressure at the gas-oil contact is as indicated (3,500 and 4,000 psi., respectively). In Reference 8 the recoveries estimated were based on the 3,500-psi. case. Inasmuch as the present injection pressure is slightly in excess of 4,000 psi., part of the reservoir will experience a Type M sweep.

*This sweepout is favorable because of the presence of a small water drive.

IN the 3 years since the publication of a preliminary report[1] on the use of high-pressure gas to increase recovery, considerable progress has been made in clarifying the concepts and developing the mechanism pertinent to this process. As a result of these advances, a much more reliable prediction of the applicability of the process to a given field can be made; and the conditions required for the successful use of high-pressure injection can be stated more clearly.

In the earlier paper all important factors which affect recovery when using high-pressure gas (except for consideration of area of reservoir contacted) were presented. These include:

1. Enrichment of injection gas by

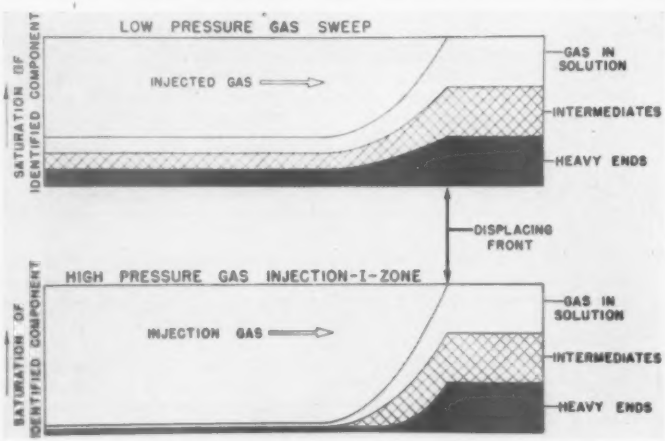

Fig. 1—Comparison of I-zone displacement with low-pressure gas sweep.

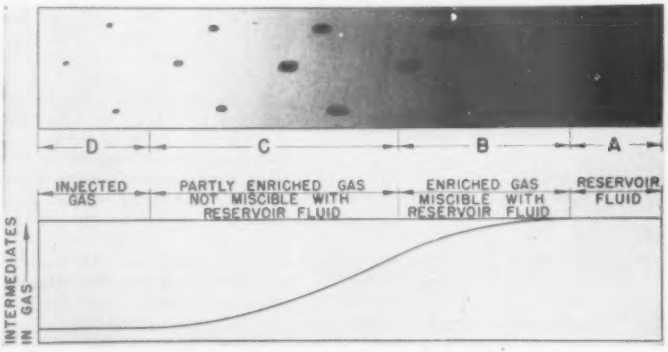

Fig. 2—Schematic representation of M-zone displacement mechanism.

Why M-Zone Repressuring Is Better Than I-Zone

Low-pressure gas drive... The upper sketch in Fig. 1 shows the distribution of reservoir fluid in relation to the displacing front for a low-pressure gas drive. Two facts should be noted here. First, the saturation of reservoir fluid behind the front decreases continuously until the residual oil value is reached, and after this value is attained there is no further change in saturation. Second, the composition of the undisplaced material is essentially the same as the virgin reservoir material. (There is the same proportion of white—gas, crosshatched — intermediates, and black—heavy components, in the residual oil as in the reservoir material ahead of the displacing front.)

High-pressure gas drive . . . Compare this situation with a high-pressure gas displacement shown in the lower sketch of Fig. 1. This drawing, following the same conventions as above, shows the saturation and composition of undisplaced oil behind the displacing front for a typical I case where the displacing phase is enriched but is still not miscible with the reservoir oil. Notice that the saturation of undisplaced material immediately behind the front decreases much more rapidly than in the previous example. This action is the result of a decrease in the vis-

. . . In High-Pressure Gas Injection?

Here's a new mechanism for increasing recovery

This article summarizes latest mechanistic concepts of Atlantic Refining's high-pressure gas-injection process. Its potentialities are indicated in Table 1 (opposite) where displacement efficiency is rated at 90 per cent, against 50 per cent for water injection. Previous articles in The Oil and Gas Journal on this subject were in June 30, 1952 (p. 87) and April 6, 1950 (p. 78), issues.

by R. L. Slobod and H. A. Koch, Jr.

evaporation of intermediates into the gas phase.

2. Solution of enriched gas in oil to increase volume of oil phase in the reservoir.

3. Reduction in difference of viscosity between injected gas and reservoir oil as a result of Items 1 and 2.

4. Approach to miscibility at the front between enriched gas and swelled reservoir oil.

5. Use of reservoir volume ratio which compares the volume of swelled reservoir oil with the volume of original stock-tank oil present in the swelled material.

All of these factors are still useful in describing the process except for the reservoir volume ratio which is no longer used explicitly, inasmuch as this quantity cannot be measured directly and is not necessary to a description of the present mechanism.

Increased recovery . . . This for the process as presented originally, is still a result of two basic actions: (1) improving of the interfacial viscosity ratio; and (2) swelling of the reservoir fluid resulting from solution of enriched injected gas. Under favorable conditions the enriched gas phase may become miscible with the diluted reservoir oil at the front.

Importance of Miscibility

When gas is injected into a reservoir at high pressures, **something more than a mere pushing out of the oil occurs.** An **exchange** of hydrocarbon components between the gas and oil takes place, resulting in a modification of the properties of both phases, particularly when the oil is undersaturated.

The intermediates (largely C_2 through C_6) are the main materials involved in the exchange. The change in concentration of these intermediates resulting from the transfer works in the direction of making the gas and oil which are in contact more alike and results in a more efficient displacement. In the extreme, when the displacing phase is enriched to such an extent that it becomes miscible with the reservoir oil, the oil is essentially "washed out" of the reservoir.

The "immiscible" case (Type "I") . . . Two conditions can be defined which cover all of the possible situations encountered when high-pressure gas is used to displace oil. In the first of these, called the **Type I case,** the enriched displacing gas is **immiscible** with the reservoir oil. Consequently, at all stages of the process, gas is displacing

Authors with The Atlantic Refining Co., Dallas. Paper presented at spring meeting of Southwestern District A.P.I. Division of Production, Fort Worth, March 4-6, and Mid-Continent District meeting, Tulsa, March 18-20, 1953.

cosity ratio $\frac{\text{viscosity oil}}{\text{viscosity gas}}$. This ratio decreases largely because the displacing gas has become more viscous and consequently is a better displacing agent.

The oil at the front also dissolves some gas which lowers the oil viscosity.

The diagram also shows that immediately behind the front the undisplaced oil is a swollen oil relatively rich in intermediates (cross-hatched). A short distance behind this zone the intermediates are being dissolved by the gas (enriching it). As a result of this exchange of intermediates the oil shrinks, resulting in a decreased oil saturation. This process continues for some distance back of the front until essentially all of the intermediates are stripped from the oil, and the only oil left as residual oil is the heavy components (black).

In the example shown the total residual oil in the I case is only about one-sixth the residual oil shown for the low-pressure gas drive. This improvement is the result of: (1) a more efficient displacement at the front because of the better viscosity ratio; (2) swelling of the oil immediately behind the front which causes more oil to flow and leaves less of the original reservoir fluid in the pore space; and finally (3) shrinkage of this swollen undisplaced oil by loss of intermediates to the displacing gas.

In Fig. 2, the reservoir fluid is represented by the dark-gray area, A. The lean gas injected to displace the oil is shown by the white area, D. As the injected gas moves through the reservoir it extracts the intermediate - weight hydrocarbons from the residual oil in its path. This enrichment of the gas is represented by the gray area, B and C. The density of the gray color is increased as the concentration of intermediates in the gas increases. Reservoir fluid bypassed **at the front** (area B) by the enriched gas which is miscible with the oil is represented by dark gray areas of the same color as the reservoir fluid inasmuch as they have the same composition.

Over an interval (area B) the bypassed oil units flow along with the miscible phase surrounding it, but at a slower rate because of their higher viscosity. In this step the bypassed oil units are somewhat reduced in volume as a result of mixing. This mixing also adds material to the enriched gas which helps maintain the condition of miscibility required for the process. In Zone C when miscibility is lost, the bypassed oil no longer flows with the gas, but is gradually extracted, with the lighter hydrocarbons going into the gas phase. Finally, residual oil is shown in Section D as black areas, the darker shade being used to show a concentration of the heavy ends as a result of the loss of intermediates to the displacing gas.

oil with an interface between the phases. This is a case similar to a low-pressure gas displacement except that a more favorable displacement of oil is possible. This is because the displacing gas is more viscous with respect to the oil being displaced; and because the undersaturated oil in contact with the gas is swelled, leaving less of the original reservoir material as residual oil. The increase in recovery resulting from these two factors is discussed below in more detail.

The "miscible" case (Type "M")... In the second case, called the **Type M**, the displacing gas becomes so enriched that the richest gas at the front is miscible with the reservoir oil. This condition, in which the displacing phase cannot be distinguished visually from the displaced phase because of the miscibility of the phases, is obviously different from an ordinary low-pressure gas drive where the displacing phase and the displaced phase are always separated by an explicit phase boundary. The reservoir oil must be undersaturated with respect to the injection pressure for this phenomenon to occur (as explained in the following section).

The removal of the phase boundary in the Type M displacement eliminates most of the effects of capillarity so that the displacement process becomes similar to that of oil by gasoline (as in a pipe line). Hence, nearly all of the oil in the pore spaces contacted by the displacing phase is displaced. The mechanics of this process are discussed in more detail in a later section.

Differentiating between I and M... Composition of the reservoir fluid, composition of the displacing gas, the temperature, and the pressure determine whether a given displacement is the I or the M case. The temperature, of course, is fixed by the reservoir conditions. The interrelation of composition (reservoir fluid and displacing gas) and pressure may be shown graphically by a triangular diagram such as shown in Fig. 3.

Triangular diagrams of this type (Fig. 3) have been used previously in extraction studies[2] and in the presentation of basic phase relationships for hydrocarbon systems.[3] In the present studies the complex, multicomponent hydrocarbon systems are arbitrarily resolved into three components, viz., C_1, C_2 through C_6, and C_7+. This division is practical from an analytical point of view and also brings out the importance of the intermediates (C_2 through C_6) in the high-pressure gas process. The arbitrary representation of the complex hydrocarbon system by a three-component analog is obviously not thermodynamically rigorous. This device, however, has proved to be of great practical value, and concepts based on this type of thinking have been verified experimentally. The success provides some basis for the use of this tool in mechanistic thinking.

Before attempting to use such diagrams, let us review briefly the information which is given on a triangular diagram such as shown in Fig. 3. Any point within the triangle represents a system with a specific composition made up of definite amounts of C_1 (methane), C_2 (intermediates—mainly ethane, propane, etc., up to hexane), and C_7+ (heptanes and heavier hydrocarbons). From supplementary information obtained in the laboratory by mixing various proportions of reservoir fluid with a gas of known composition, the phase boundary curve ABC for a given temperature and pressure is obtained by observing which compositions give two phases and which yield a single phase.

The single-phase region lies outside the two-phase region ACB. Saturated gas compositions lie along curve BC, while saturated liquid compositions are represented by line AC. The tie line (determined experimentally) is drawn between the points representing the composition of the gas and liquid which are in equilibrium at a given temperature and pressure.

The I zone is separated from the M zone by a line through the critical mixture C parallel to the limiting tie line (explained more in detail later and in Fig. 7). With this information and the known composition of the reservoir fluid and injected gas, it is possible to predict whether a given high-pressure displacement will be of the immiscible or miscible type.

Example... The composition of reservoir fluid H (Table 4) is represented by the X within the circle near the center of the diagram of Fig. 4 which is similar to Fig. 3, but contains a family of curves representing effect of pressure on a given system (temperature constant). Phase boundary curves for 3,000, 3,500, and 4,000 psi. are labeled. The dividing lines between I and M zones for these pressures are also shown.

From the location of point X and the I-M boundary lines shown, it is apparent that at 3,000 psi. fluid H is of such a composition that the displacement process (using gas of composition shown by point LG) falls in the I zone. At higher pressures the boundary curves more to the left so that at 4,000 psi., the composition of reservoir fluid H

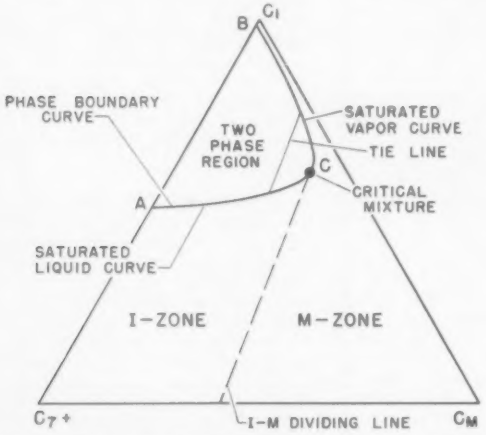

Fig. 3—Three-component representation of multicomponent system—temperature and pressure constant.

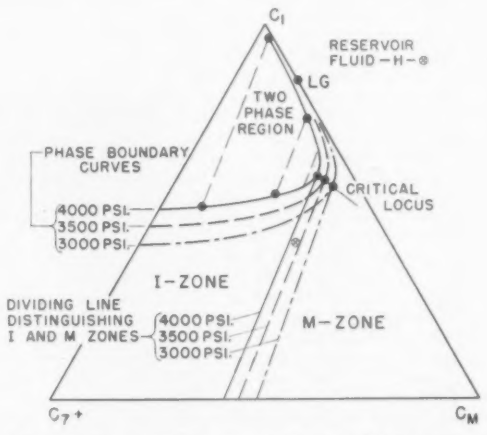

Fig. 4—Effect of pressure on miscibility in high-pressure gas injection.

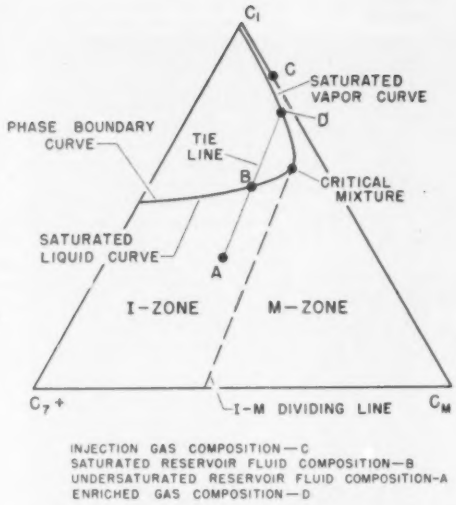

Fig. 5—Illustration of the effects of undersaturation in I-zone displacements.

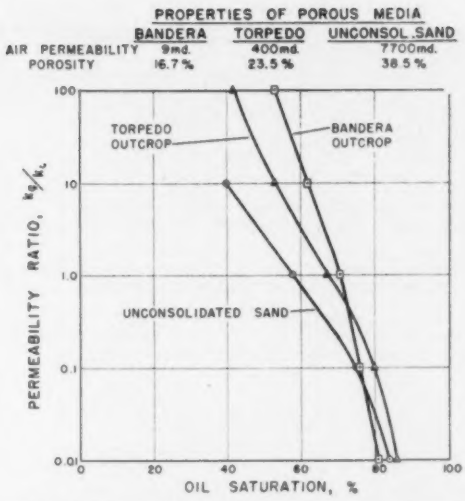

Fig. 6—Relative-permeability characteristics of porous media used in flow tests.

is such that an M-zone type displacement will occur.

M zone factors . . . The two factors that are the most important in placing a high-pressure gas injection in the M zone are reservoir fluid composition and injection pressure. At 4,000 psi., reservoir fluids usually must contain a high (35-40 mol per cent) concentration of C_2—C_6 components to be in the M zone. (For example, reservoir fluid H contains 37 mol per cent intermediates.) For fluids containing a lower concentration of intermediates, significantly higher injection pressures must be used.

This type of information is useful when studying a new field. A diagram such as Fig. 3 is developed based on the composition of the reservoir fluid, the composition of the injected gas, and the reservoir temperature. The performance of the system[4] then may be predicted. At the present stage of development, these predictions are checked by high-pressure displacement experiments in the laboratory. Eventually, it is probable that experimental checking will not be necessary except in unusual or borderline cases.

Displacement Mechanism Describing Immiscible Zone Case

Recoveries resulting from Type I displacements in which essentially immiscible phases are formed at the front between enriched injected gas and reservoir fluid are controlled by:

1. Degree of undersaturation of the reservoir fluid with respect to the proposed injection pressure.
2. Effective interfacial viscosity ratios.
3. Relative permeability characteristics of the porous medium.

(a) Mechanism representation . . . The benefits associated with a Type I displacement as compared with a conventional low-pressure gas displacement are shown schematically on the two sketches of Fig. 1. In each case reservoir fluid made up of three constituents (heavy components—black, intermediates — cross-hatched, and gas—white) is shown being displaced by injected gas (white).

The saturation of the reservoir fluid (broken down into the three groups—heavy, intermediates, and gas) at a given point in the system is represented by the height above the horizontal axis.

(b) Degree of undersaturation . . . To demonstrate the importance of undersaturation as a factor contributing to extra recovery in high-pressure gas injection, compare the behavior of an undersaturated oil with that of an oil being displaced at its saturation pressure. This comparison is illustrated in Fig. 5 where the composition of the undersaturated reservoir fluid is represented by A and the saturated reservoir fluid by B.

In the case of the undersaturated reservoir fluid, after "infinite" contacts between injected gas C and the reservoir oil A, equilibrium will be established at the front, yielding rich gas of composition D and an oil phase of composition B. This change (fluid A converted to fluid B) represents a swelling of the oil. In other words, fluid B has a larger formation volume factor (FVF) than the original reservoir fluid. Consequently, for any given efficiency of displacement, fewer stock-tank barrels of oil will be left in the reservoir than when no solution effects are present.

In the case of the saturated reservoir fluid, after "infinite" contacts between gas C and reservoir fluid B, the injected gas will be enriched to composition D, as in the foregoing case, but the residual oil will be unchanged (composition B). Obviously in this case, because no swelling of the oil occurred, no additional recovery can be ascribed to formation volume factor effects. It should be realized that the enrichment of the gas results in a more favorable viscosity ratio, which improves the displacement efficiency.

(c) Viscosity ratio effects . . . The displacement efficiency of a gas-injection process depends directly upon the interfacial viscosity ratio, increasing as the viscosity of the gas and liquid approach one another. In this work the effect viscosity ratio governing displacement efficiency is postulated to be the viscosity of the enriched gas at the front divided by the viscosity of the swollen oil in equilibrium with it. With reference to Fig. 5, in which undersaturated reservoir fluid A is displaced by gas C, the effect interfacial viscosity ratio is the viscosity of oil B divided by the viscosity of enriched gas D. These interfacial fluids may be approximated experimentally for a specific reservoir fluid by multiple contact batch phase

TABLE 2—COMPARISON OF EXPERIMENTAL AND CALCULATED RECOVERIES FROM LOW-PRESSURE NITROGEN DISPLACEMENT OF NAPHTHA ($\mu_o/\mu_g = 30$). BASED ON BUCKLEY-LEVERETT METHOD AND DATA IN FIG. 6

Core—	Breakthrough recovery, per cent of oil in place		Recovery after injecting 1 pore volume of nitrogen	
	Observed	Calculated	Observed	Calculated
Unconsolidated sand	32.0	30.0	45.0	41.0
Torpedo outcrop	*13.0	20.0	33.5	34.0
Bandera sandstone	28.7	26.3	32.8	31.5

*Low breakthrough probably result of a fracture in the core. Production after breakthrough high so that at one pore volume production caught up with predicted value.

TABLE 3—DEMONSTRATION OF IMPORTANCE OF VISCOSITY RATIO AND FORMATION VOLUME FACTOR ON RECOVERY IN TYPE I DISPLACEMENTS

	Case I	Case II	Case III
Displacement pressure, psi.	1,000	3,000	3,000
Saturation pressure of virgin reservoir fluid, psi.	1,000	3,000	1,000
Viscosity of displacing phase, cp.	0.02	0.02	0.02
Reservoir oil in place, bbl.	100	100	100
Stock tank oil in place, bbl.	83.5	66.7	83.5
Reservoir oil saturation of breakthrough, per cent	80	60	60
Stock-tank oil in reservoir at breakthrough, bbl.	66.7	40	40
Stock-tank oil produced from reservoir at breakthrough, bbl.	16.8	26.7	43.5
Stock-tank oil produced at breakthrough, per cent of oil in place originally	20	40	52.1
Stock-tank oil produced at abandonment gas-oil ratio (30,000 standard cu. ft. per stock-tank bbl.), per cent of oil in place originally	35	55	65

PROPERTIES OF INTERFACIAL FLUIDS AS A FUNCTION OF PRESSURE

Pressure, psi.	1,000	3,000	Viscosity ratio	40	16.7
Oil viscosity, cp.	0.80	0.50	Formation vol. factor, reservoir bbl. per stock-tank bbl.	1.20	1.50
Gas viscosity, cp.	0.02	0.03			

TABLE 4—COMPARISON OF EXPERIMENTAL AND CALCULATED RECOVERIES FROM TYPE I DISPLACEMENTS FROM LABORATORY CORES USING MODIFIED BUCKLEY-LEVERETT METHOD AND DATA FROM FIG. 5

	Core—	Injection press., psi.	Reservoir fluid	Stock-tank oil production, per cent of oil in place: Virgin stock-tank oil, Observed	Virgin stock-tank oil, Calculated	Ultimate recovery, Observed	Ultimate recovery, Calculated	No. of pore volumes of gas injected ultimately
1	Unconsolidated sand	1,000	G	23.5	34.7	58.5	54.2	1.40
2	Unconsolidated sand	2,000	G	45.9	65.7	68.0	77.1	1.40
3	Unconsolidated sand	2,900	G	57.1	67.5	76.8	81.0	1.35
4	Unconsolidated sand	3,700	G	62.1	73.4	85.0	85.0	1.43
5	Unconsolidated sand	2,900	H	48.8	52.0	67.2	66.3	1.19
6	Unconsolidated sand	3,500	H	62.6	62.6	77.6	73.6	1.10
7	Torpedo	2,900	H	35.6	43.5	55.7	57.6	1.10
8	Torpedo	3,500	H	46.5	53.0	67.0	65.5	1.10
9	Bandera	2,900	H	33.6	36.0	49.0	53.0	1.27
10	Bandera	3,500	H	40.1	44.9	63.8	61.1	1.31
11	Bandera	2,900	G	39.4	57.1	57.4	71.5	1.30

studies of the type described previously.[1] Viscosity of these fluids may then be measured by means of a suitable viscosimeter.

(d) Effect of porous medium . . . The effect of relative permeability characteristics and interfacial viscosity ratios on recoveries resulting from low-pressure gas sweeps is well established.[4] The results of studies in this laboratory involving low-pressure displacements of naphtha by nitrogen from three different types of cores are cited in Table 2 to show the fair agreement between experiment and theory. The k_e/k_∞-liquid saturation relationship of the cores used in the experimental program are shown in Fig. 5. These data were determined in the absence of connate water so as to be consistent with other data obtained in the high-pressure gas process study in which no connate water was present. Several small-scale experiments have been carried out with connate water present which indicate that connate water has no important effect on the recovery mechanism of the high-pressure gas-injection process.

Recent work has shown that the recovery expected in Type I displacements can be calculated on the basis of the proposed mechanism by using the viscosity ratio at the front, the formation volume factor, and the relative permeability data in a modified Buckley-Leverett type of calculation.[5]

(e) Illustration of effect of viscosity ratio and undersaturation on recovery. Table 3 has been prepared to illustrate the effects of improved viscosity ratio and "swelling" on recovery from a typical Type I displacement. The properties of the fluids and the recoveries cited are assumed values for purposes of illustration.

Improvement of viscosity ratio from 40 (Case I—saturated fluid displacement at 1,000 psi.) to 16.7 (Case II—

(Continued on page 115)

TABLE 5—COMPOSITIONS (MOL FRACTION) AND PROPERTIES OF FLUIDS USED IN HIGH-PRESSURE STUDIES

Component:	Designation of reservoir fluid— G	H	I	J	K	L	M	N	Lean gas	Rich gas
C_1	14.3	42.7	35.9	54.1	38.7	34.0	38.9	51.4	87.9	72.4
C_2	6.8	12.5	6.8	14.8	8.4	2.1	1.4	9.7	11.6	16.4
C_3	5.9	10.2	8.3	9.3	7.2	3.1	3.4	8.8	0.5	8.0
C_4	7.4	6.2	6.9	4.5	5.6	5.7	4.1	5.4	.....	2.2
C_5	6.8	3.8	4.7	2.0	4.9	4.0	2.8	2.6	.....	0.6
C_6	6.8	3.3	4.6	2.0	4.0	2.3	3.1	1.8	.....	0.1
C_{7+}	52.0	21.3	32.8	13.3	31.2	48.1	46.3	18.8	.....	0.3
CO_2	.....	.....	.....	.....	.....	0.7	0.2	1.5	.....	.....
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Bubble point, psi.	800	2,760	2,200	3,950	2,800	2,186	2,320	3,780	.....	.....
Temperature, °F.	144	140	167	140	121	224	182	237	.....	.....
Viscosity, cp.	0.70	0.30	0.56	0.14	0.56	0.74	0.84	0.08	.....	.....
FVF at saturated pressure	1.17	1.82	1.42	2.18	1.42	1.33	1.23	3.10	.....	.....
Mol weight C_{7+}	186	191	176	196	221	203	245	142	.....	.....
Mol per cent (C_7-C_6) / Mol weight C_{7+}	0.18	0.19	0.18	0.17	0.14	0.08	0.06	0.21	.....	.....

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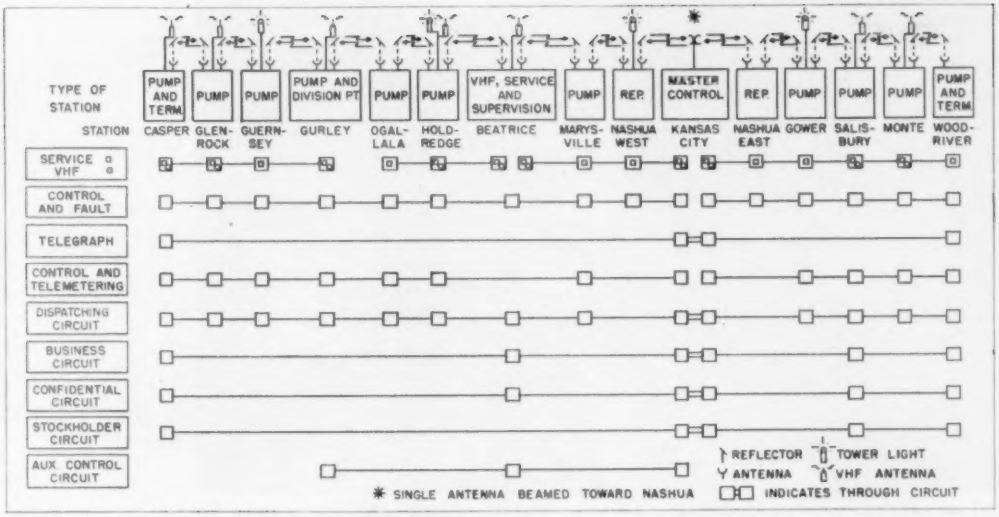


Fig. 1—Channelizing diagram showing terminal, pump, district, and master control station circuit functions for Platte Pipe Line System.

Platte Pipe Line has provided for maximum efficiency, minimum maintenance, with

. . . Communications and Controls Systems

by Morton L. Long*

Supervisory control and telemetering equipment provides up to 12 functions per station for all pump and terminal stations of the 932-mile line

IN keeping with the advanced engineering design incorporated into the planning of the Platte Pipe Line a microwave relay system, the most advanced type of communications system developed to date, was chosen to provide the intricate network of control and communications required.

To describe microwave as a communications system does not adequately present the entire picture, for this system embodies the facilities for remote pump-station control, telemetering, dispatching, confidential dial voice circuits, V.H.F. communication with remote transmitter selection, and party-line voice and telegraph circuits. In order to provide the greatest reliability with a minimum maintenance factor, such features as complete microwave and power standby and fault signaling are provided.

System scope . . . The system consists of 44 stations extending along the pipe line through the states of Wyoming, Nebraska, Kansas, and Missouri, linking the Casper, Wyo., and Wood River, Ill., terminals. The entire system is controlled from the main pipe-line headquarters in Kansas City, Mo., except for the V.H.F. circuits. V.H.F. is divided into three sections and controlled from stations at Casper, Beatrice, Nebraska, and Kansas City. All telemetered readings are supervised and push-button control exercised for the entire 932-mile system from a single console located in Kansas City.

Communication functions . . . The accompanying channelizing diagram, Fig. 1, serves to detail the communication and control functions as they are distributed throughout the stations in the system. The 29 unattended repeater stations contain primary and standby microwave repeater units, voltage regulators, service channel, and fault tone equipment. Seventeen stations also include V.H.F. transmitters and receivers for V.H.F. communication with supervisory and maintenance vehicles.

The 11 microwave stations at the pipe-line pump stations also include multiplex equipment for dropping out the voice carrier channels and telemetering and supervisory control tones. The terminal stations contain equipment which performs similar functions to those specified for the pump-station repeaters.

An accompanying photograph, Fig. 2, shows a typical lineup of equipment for a terminal station. The duplex microwave units stand at the right and show provisions at the top of each unit, for connection of the wave guide which runs to the microwave antennas. The two racks on the left contain carrier telephone units, telegraph units, the dial selector unit, matching and distribution panels, voltage regulators, 20-cycle ringing supply, and power supplies.

Repeater-station equipment . . . At each of the 44 repeater stations the microwave equipment operating in the 6575-6875-mc. industrial frequency band, is connected to the antennas by means of rectangular waveguide having outside dimensions of ¾ by 1½ in. Wave-

* Project Engineer, Philco Corp.

Fig. 1a—Platte Pipe Line Co. control headquarters at Kansas City, Mo., showing western division control console with pipe-line flow chart mounted on walls.

guide switches are provided for transferring the microwave traffic signal by switching the wave-guide connections from the primary to the standby relay unit in case of equipment failure.

The antennas for the system are 4 ft. and 6 ft. in diameter, having signal gains of 36 db. and 40 db. respectively. In all cases, except at Kansas City, the antennas are horizontally mounted on the roof of equipment shelters. Energy, concentrated into a pencil beam by the parabolic curvature of the antenna, is directed vertically upward toward plane reflectors mounted at the top of the towers. The reflectors, mounted at an angle of approximately 45°, intercept the vertical beam deflecting it horizontally toward the next adjacent repeater station.

Reflectors are of 4 and 6-ft. sizes, but are slightly longer in the vertical dimension so that when mounted at 45° the plane of interception is approximately square for both horizontal and vertical projection.

The towers provide minimum twist and deflection of the reflector mounting so that, at winds as high as 80 m.p.h., so little deflection of the microwave beam is experienced that the overall system performance will be slightly affected. Tower heights have been computed to give adequate line-of-sight clearances between repeater stations.

The antenna-reflector signal gain is directly affected by the distance between the two elements. The signal loss between adjacent station reflectors is a function of the distance between the stations. Thus, in arriving at the sizes for these two elements both dis-

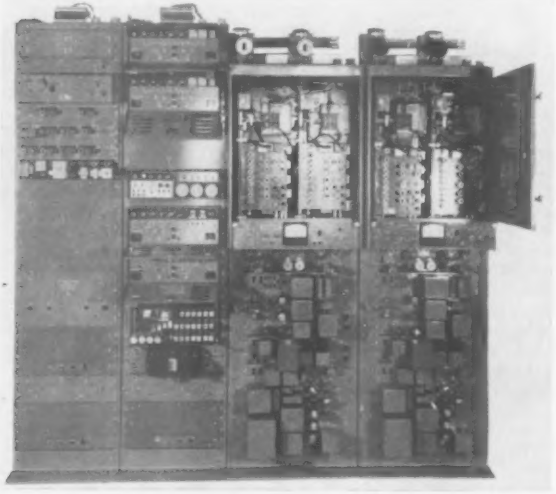


Fig. 2—Typical lineup of microwave relay and multiplex equipment at a pipeline terminal station.

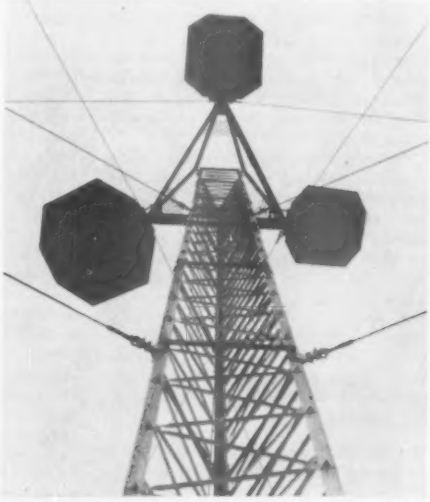
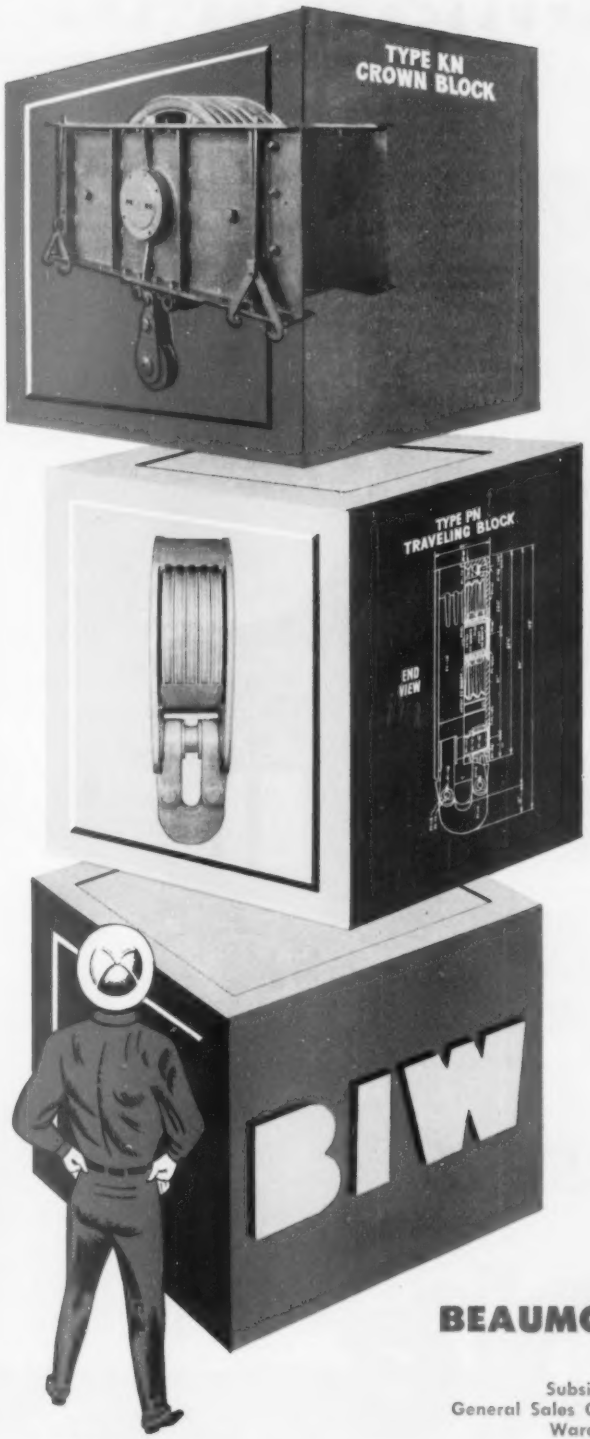


Fig. 2a—Microwave tower at Nashua, Mo., showing tower-mounted reflectors.



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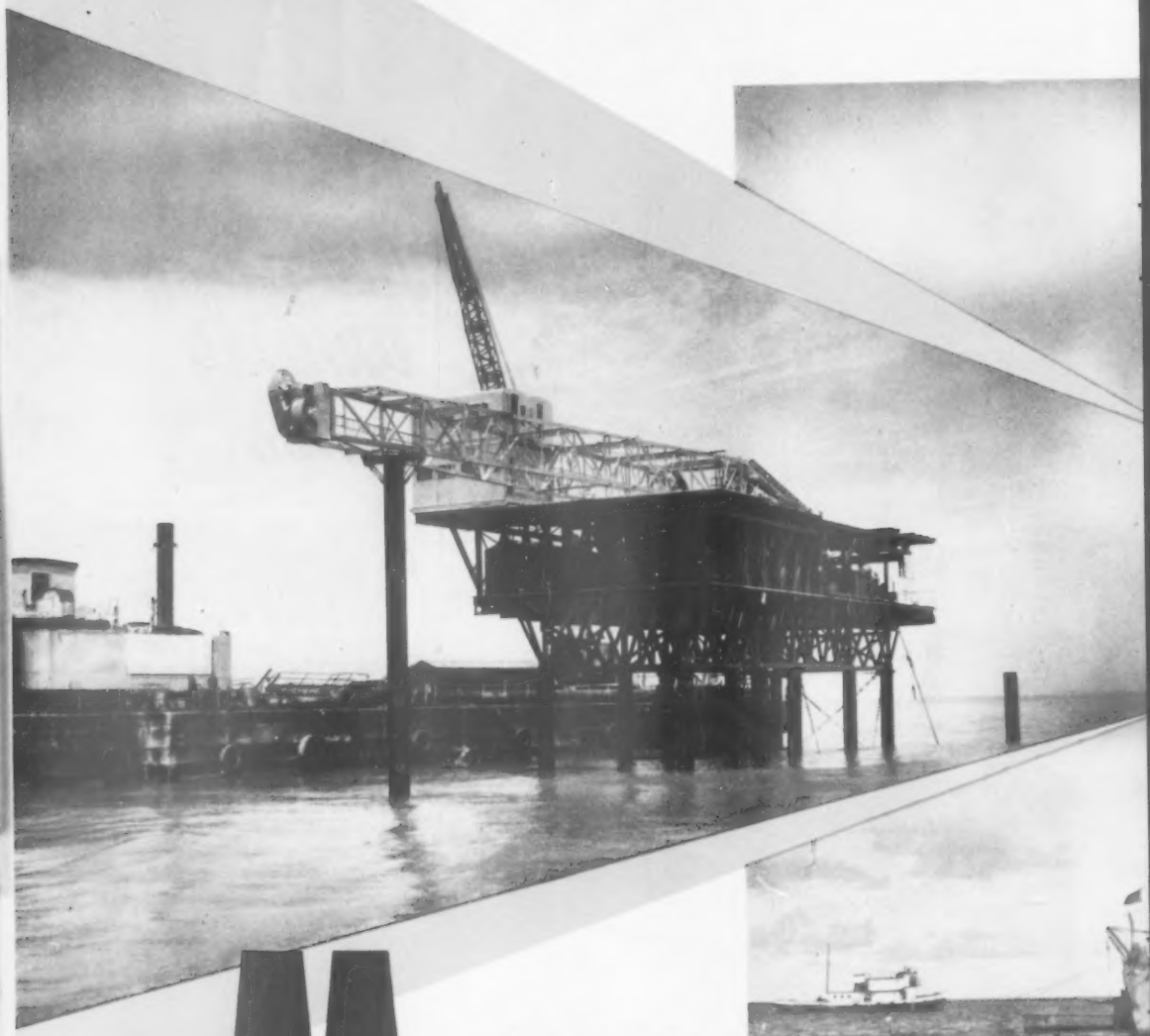

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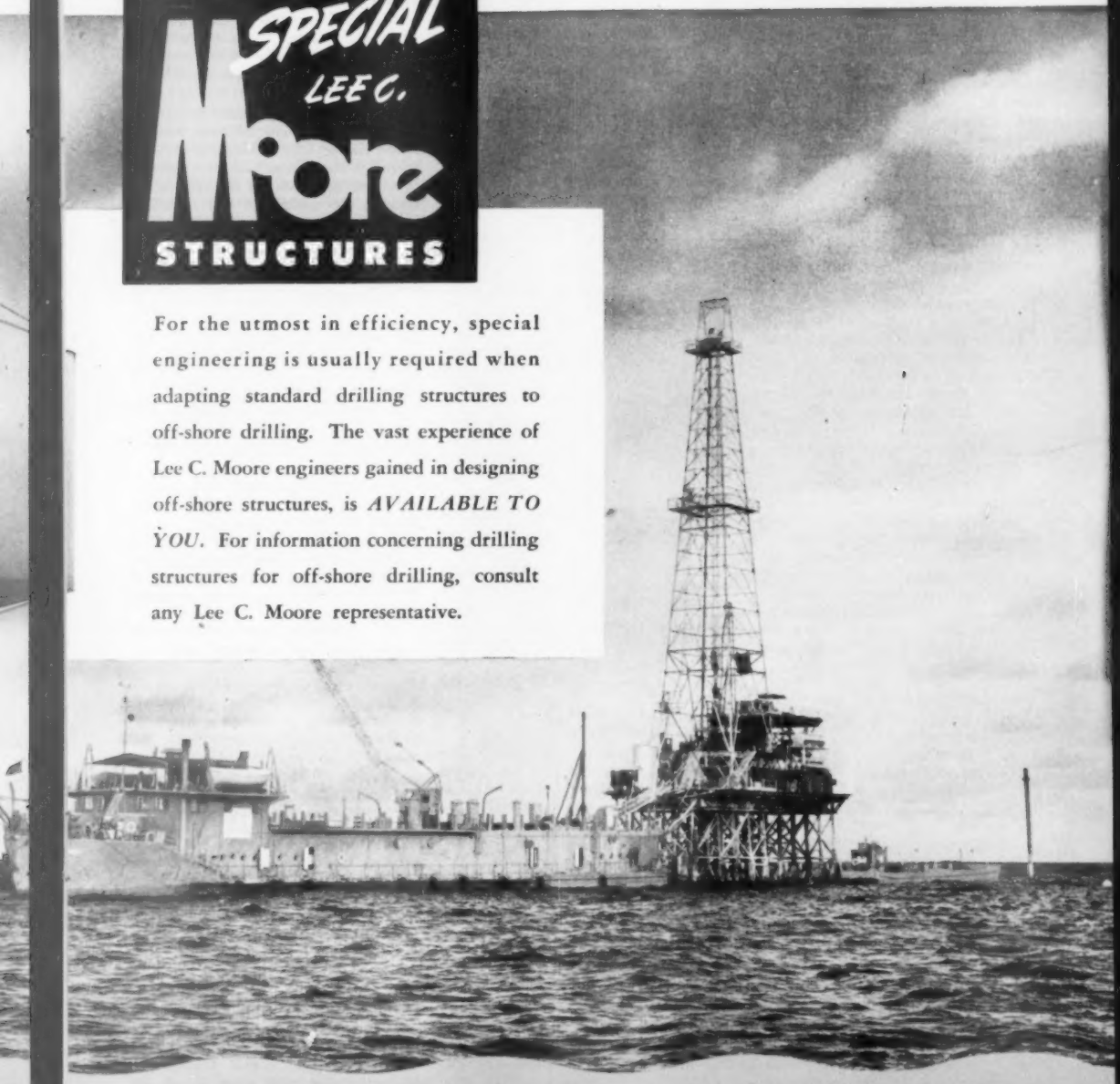

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tances must be taken into account so that the required signal level will be available at the receiving equipment to provide an operational safety margin for a maximum of reliability.

Tower lighting . . . Where tower heights have exceeded 170 ft. it has been necessary to light the towers to conform to Civil Aeronautics Administration requirements. This lighting consists of a beacon containing two paralleled 500-watt lamps at the tower top, flashing at a rate of 40 on-periods per minute and two individual, continuously-energized 100-watt lamps at the one-third and two-third levels.

The tower lighting system is controlled by a photo cell which energizes all the light when the daylight illumination falls below a preset value. In case of failure of the tower lights, a fault indication is automatically transmitted over the microwave system to the main control and dispatch console at Kansas City.

The equipment shelters for all microwave stations, except Kansas City, are of the preset concrete slab type. Various sizes are used ranging from 8 by 12 ft. at the unattended repeater stations, to 12 by 20 ft. at the pump stations. The shelters are divided into two compartments by a fireproof partition, each compartment having its own separate entrance.

One compartment is for the electronic equipment while the other is for the power generators. Each contains means for intake and exhaust of outside air. The microwave compartment has an exhaust fan, thermostatically controlled, while the generator compartment circulation is by means of the motor generator fan.

Auxiliary generators have been specified in two sizes—5 kw. and 10 kw.—the smaller unit being utilized at the repeater stations and the larger unit at the pump and terminal stations. Provision is made for the automatic switchover of the station load from the primary line to the standby generator during any period of line failure.

The line failure must exist for a period longer than 5 seconds to cause the switchover. Once the standby unit has taken over, it operates for a period of not less than 15 minutes after restoration of primary power in order to charge its batteries and to be ready to accept the load in case of a recurrent failure. A fault indication is reported to the Kansas City control console upon failure of primary power.

All microwave equipment specified for primary and standby repeater and terminal use are essentially identical making for ease of maintenance. The change of function is provided by a strapping arrangement within the main i.f. amplifier chassis. Thus, spare-part inventory is maintained at a minimum since a replacement unit can be prepared on the spot for use.

Microwave operation . . . These units operate on a feedback principle. Each unit receives and retransmits signals traveling in opposite directions to provide full duplex operation of the entire system. Duplexing of the waveguide equipment enables one antenna to serve as both the receiving and transmitting element for each direction.

A single klystron tube is used both as the transmitting power tube and as the high-frequency local oscillator. The received signal entering the r.f. mixer by means of the antenna, waveguide, and r.f. filter is heterodyned with the local oscillator signal providing an i.f. signal of 90 mc. which is amplified, limited and then detected by an F.M. discriminator to provide the A.M. intelligence signal of approximately 50 to 600 kc. band width.

A d.c. amplifier further raises the level of this signal to drive the reflector of the klystron to produce the F.M. output at 6,700 mc. Nominal working levels are −45 db. received signal level and 1 watt power output so that a signal amplification of approximately 32,000,000 is accomplished in each repeater.

A safety margin of 30 db. is designed into each microwave hop. Thus a repeater is capable of providing an amplification of 32 billion under extreme conditions and still provide satisfactory operation of the entire system.

The fact that a portion of the transmitted signal is used as the local oscillator signal gives rise to the term "feedback repeater." The transmitted signal follows, in frequency, the received signal thus producing an amplified signal of minimum distortion.

The signal path through the repeater exists twice in each repeater unit, once for each direction. Provision is made for two-way dropout and insertion of local signals at each repeater station.

The frequency stability of the terminal unit is controlled by an r.f. waveguide discriminator which feeds back correcting voltages through the d.c. amplifier to the klystron reflector maintaining the unit on frequency. Each succeeding unit is tied in output frequency to its received signal frequency; thus system frequency is maintained by the terminal discriminator.

In case of failure of any repeater unit in the system to receive a signal, its operation reverts to a terminal condition whereby an r.f. discriminator within the unit is made to control its frequency and the frequency of the remainder of the system.

Standby equipment . . . Where standby equipment is used the repeater operation is switched to the standby unit 2 seconds after the signal loss, whereupon the standby unit will proceed to operate: (1) as a terminal, if failure of the signal has been due to propagation failure or; (2) as a repeater, if failure of the signal has been due to a primary equipment failure. Upon return of the received signal, in the former case, the unit will immediately operate as a repeater.

When standby equipment is carrying traffic, a remote-control tone initiated at the Kansas City headquarters is used to switch the station back to a primary operation condition. If the fault is not cleared, the equipment will return to the standby condition. Fault reports are transmitted back to Kansas City control office in the event of switchover of operation to standby.

The multiplex equipment permits the obtaining from the microwave unit the full communications and control features desired. Nine voice channels are provided from which are derived the following functions:

1. Service channel (dropped at each repeater) and V.H.F. voice channel (dropped at V.H.F. land transmitter locations).
2. Dispatching circuit (party line, dropped at all stations except unattended repeaters).
3. Confidential dial circuit (dropped at district, control, and terminal offices).
4. Business circuit (party line, dropped at terminals, district and control offices).
5. Voice circuit (party line, connecting terminals and district offices).
6. Circuits for supervisory control, telemetering, fault reporting, and V.H.F. control are also provided in the microwave channel pass band.
7. Teletype circuit (connecting terminals, district and control offices).

In addition to the above functions, provision is made for future expansion of voice circuit equipment.

V.H.F. setup . . . The V.H.F. radio channel is divided into three sections operating Casper to Gurley, Neb., Gurley to Kansas City, and Kansas City to Wood River. Several special features have been incorporated into the V.H.F. control. From the above control points the radio operator can page a vehicular station from all transmitters within the section simultaneously.

When the vehicle states its location, the operator dials the nearest V.H.F. land station to the vehicle, automatically muting the other receivers in the section, providing a maximum in communications efficiency. Upon return of the handset to its cradle, when the message is complete, all receivers are

unmuted and normal monitoring of the channel is maintained.

A unique feature is incorporated into the Gurley - Kansas City and Kansas City - Wood River sections of the radio system whereby normal control of the two sections can be switched from Kansas City to Beatrice, Neb., merely by throwing a toggle switch at each station.

The V.H.F. equipment operates in the 150-mc. band on two frequencies so that vehicles may intercommunicate on one frequency without disturbing the system communication, or may communicate with the land stations on the second frequency. The V.H.F. network has been designed to provide continuous mobile-to-land station operation along the entire pipe line and as far to the side of the line as 20 miles.

Control equipment . . . The supervisory control and telemetering equipment provides up to 12 functions per station for all pump and terminal stations on the system. Such operations as initiating complete station shutdown, starting and stopping main-line motor, opening and closing valves, and actuating pressure controllers are automatically controlled.

These telemetering functions are on a continuous and selection basis, such readings as discharge and suction pressure and rate of flow being continuously recorded on meters located at the Kansas City control office. Selective telemetering of tank levels and pressure is provided upon control interrogation from the main office console.

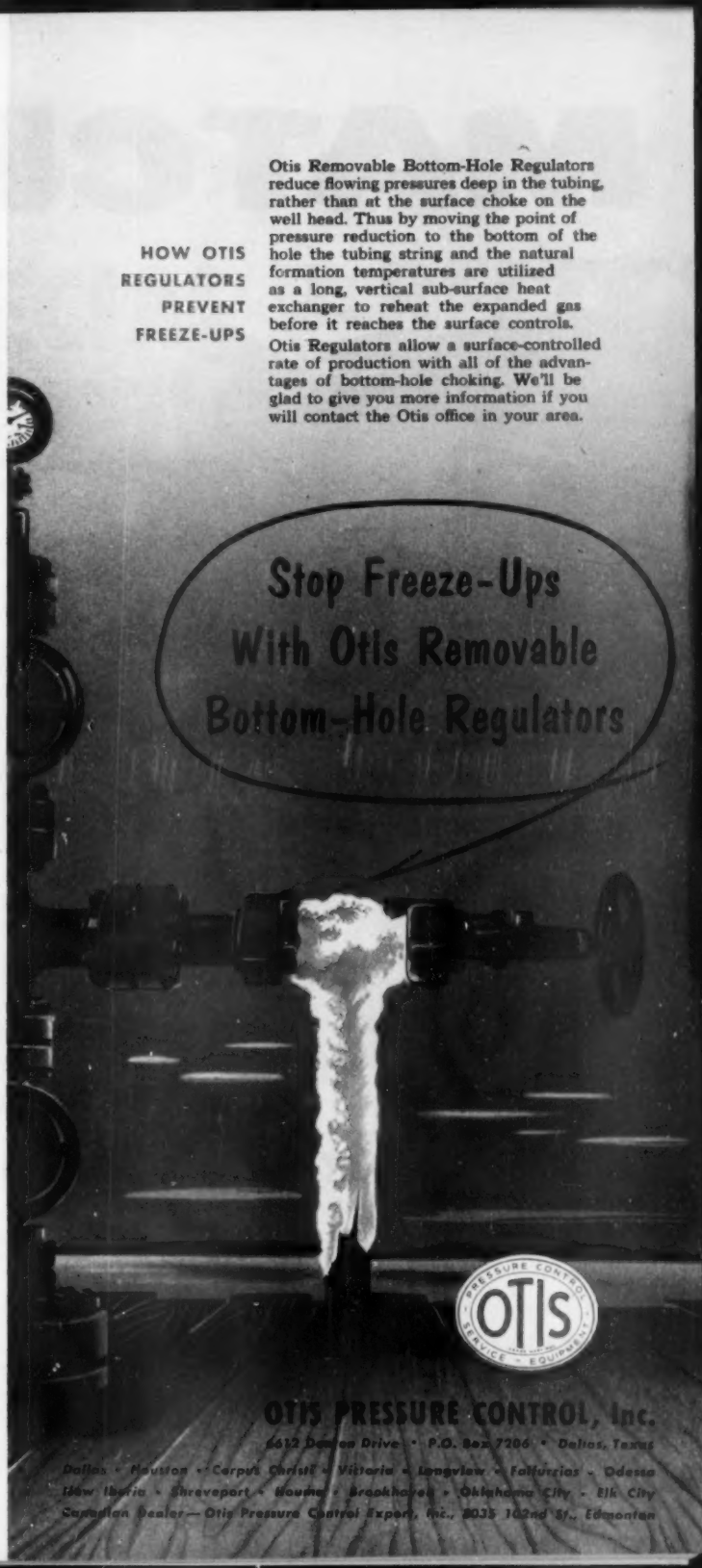
The supervisory control equipment operates on a sequential tone basis and provides means for indicating remote station operating conditions at all times. Indication is also given when operation is initiated at the control console. Continuous visual indication of the station operating condition is given during the entire period until the local sequence of operations has been completed by remote control.

Equipment for the microwave relay system is being furnished by Philco Corp.

BOOK

ATMOSPHERIC POLLUTION—ITS ORIGINS AND PREVENTION. By A. R. Meetham. Published by Pergamon Press, Ltd., 2, 3, and 5 Studio Place, Kinnerton Street, London S.W. 1, England. 268 pp. $4.90.

It has been estimated that over 8 million tons of atmospheric pollution is produced each year in Great Britain from the combustion of coal and its derived fuels. This causes far more damage than pollution from any other source. Pollution from fuel is therefore the main subject of this book, which is meant to be of use to all who are professionally interested in atmospheric pollution—public health officers, smoke and sanitary engineers, architects, engineers, meteorologists, builders, and legislators.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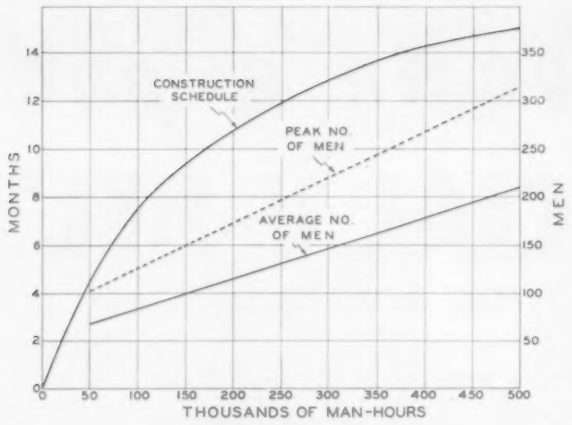

Fig. 1—Construction schedule chart.

BUILDING REFINERY PROCESS UNITS—3

. . . Scheduling Construction

Expediting should be aimed toward maintaining, not radically improving, the required date.

by M. Mattozzi*

AS indicated by the first two articles in this series, the subject of planning and scheduling design and construction of process units is by no means an exact science. This is even more pronounced when planning the construction phase. However, as was the case with engineering and drafting, there is certain fundamental logic that can be applied to almost any job.

When outlining an erection program, there are many variables to be considered as the geographic location of the project, weather conditions, the local labor situation, etc. Precise calculation of some of these factors is extremely difficult if not impossible. For example, labor efficiency varies considerably even within the United States, and certainly weather conditions would influence our thinking to a greater extent on a job being erected in Wyoming than it would if the same job were being built in Texas.

Also in certain areas piping cannot be shop fabricated below certain sizes and in other cases foundation reinforcing rods must be bent at the job site. Such situations of course tend to increase the amount of direct field labor and should also be taken into account.

*Arabian American Oil Co.

Parts 1 and 2 explained how the format for the master schedule is established and what steps are taken to plan the engineering and drafting operations. The mechanics of outlining the construction phase, including the projection of material requirements, will now be dealt with.

Estimating Field Man-Hours

Again reference is made to the job estimate to obtain some idea of how many man-hours of **direct labor** will be required for the entire program. If the estimate does not include man-hours, this information can be obtained by dividing the average hourly wage rate into the labor dollars. However, if these data are also unavailable, a very rough "guesstimate" of field man-hours can be calculated by assuming that it will require 18,000 man-hours to erect each $100,000 worth of materials on the basis of 1946 costs rated at 100 in the Refinery Index. This figure was developed by analyzing 42 million dollars of refinery construction covering 15 assorted types of process units, costing 1½ to 4 million dollars each. It is not, therefore, representative where total job costs are beyond those limitations.

When the total direct field man-hours have been obtained, the length of the construction program can be calculated, based on the weather and labor conditions noted above, and by referring to Fig. 1. On this figure, in addition to the time scale, the average labor force is plotted together with the peak force which is 1½ times the average in accordance with Fig. 2 of Part 1. The data represented in Fig. 1 of this article were gathered from the writer's experience in scheduling construction on approximately 300 million dollars of varied oil refinery process units.

Based on average performance . . . The reader is cautioned that Fig. 1 is based on average performance throughout the United States, and unless the individual planning construction for a specific job has excellent reasons for deviating from same, it is strongly urged that these data be used as a basis, and then such factors as high or low labor efficiency, extreme climatic conditions, etc., be evaluated if possible. In this connection, it should be noted that a shorter construction period is usually more efficient and accordingly, it has proven advantageous to schedule a little "tight."

The Disrupted Schedule—Don't Start Too Early!

When to start construction? . . . This is the point at which most schedules go astray due to a general optimistic viewpoint in this regard. Actually, the question might better be phrased "How late can construction start without losing full advantage of expected material deliveries?" With this sort of outlook, the possibility is diminished, for example, of installing foundations and then awaiting delayed arrival of major equipment, thereby necessitating curtailment of construction activity and some times causing complete stoppage of field operations.

These situations when they occur are extremely difficult to explain and the uninitiated usually conclude that the simple solution is to improve the delivery of major components. In actual practice, those "in the know" realize that the solution is not quite so simple since it requires that vendors be asked to reschedule production or fabrication. While most are willing to cooperate, the mere fact that they, too, have shop schedules to maintain, often makes such rescheduling impossible and rather unfair.

Finding the critical items . . . When preparing a detailed construction program, an analysis should be made of the probable delivery of all major equipment and materials with the thought of exposing which items will

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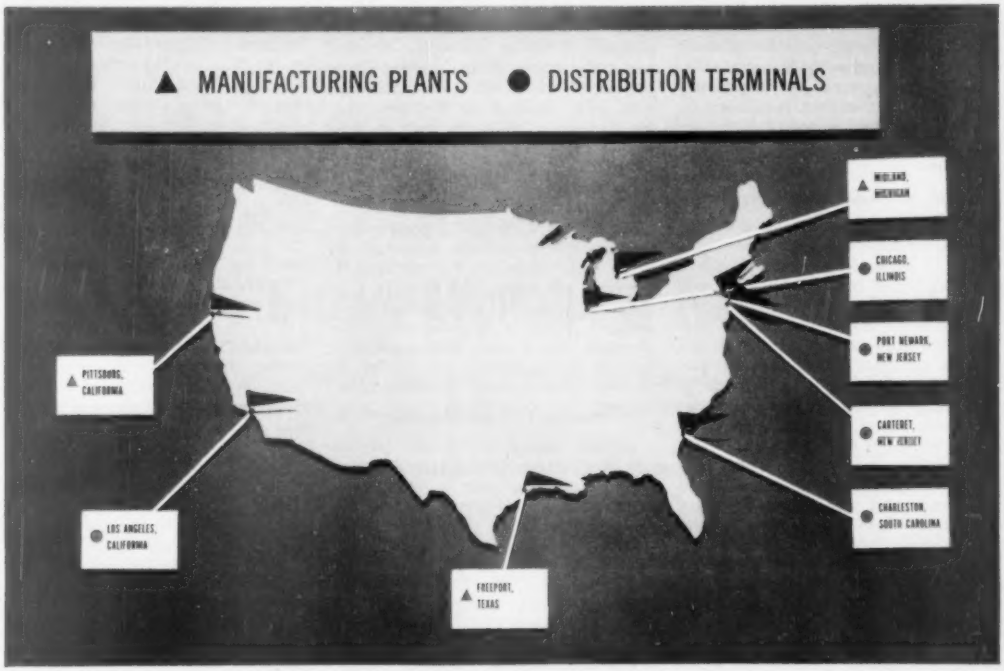

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be limiting or critical. For example, referring to Fig. 1, Part 1, it was determined that the fractionating columns, items 1 and 3, could reasonably be expected by February and March, and that the other major items could be obtained by that time or sooner. Accordingly, the start and completion of foundations for this area are geared to the expected arrival of the columns and subsequently all the other operations within the area are scheduled in a logical construction sequence.

However, by way of example, assume for the moment (and this is purely a hypothetical case) that the fabricated piping, item 12, could not be shipped until October. In that event, delivery of the towers in February and March would not be critical, since after these had been erected, a 3-month delay would be experienced before starting piping and the unit could not possibly be completed prior to December 31. Accordingly, erection of the vessels and, as a matter of fact, installation of foundations would be geared to the delivery of fabricated piping, the limiting item.

Length of Construction Operations

With respect to the length of the individual construction operations, this is purely a matter of good judgment on the part of the individual preparing the schedule. The writer cannot possibly offer any magic formula that will solve this problem since each operation can differ so radically. For example, a 100-ton tower shipped in three shop-fabricated sections may require only two or three circumferential welds, whereas a 60-ton tower of larger diameter which could not be transported except knocked down would be completely field fabricated and require considerably more man-hours and time. Similarly 500 yd. of concrete in one pour requires fewer man-hours than the same amount of concrete in a scattered quantity of pump blocks. The best method that can be offered is to apply a relative weight or time factor to each foundation, column, steel structure, etc., bearing in mind the size, design, complexity, amount of prefabrication, and field man-hours estimated for total foundations, vessels, structural steel, and so forth.

Staggering the work . . . While each "task area" or division of work is scheduled in a similar manner, careful consideration should be given to staggering the areas sufficiently so that a summation of cumulative man-hours would produce the "ideal construction curve" as per Fig. 2 of article 1, within the limitations of the over-all construction period obtained from Fig. 1, this article. Such an analysis, if necessary, can be made by applying the relative weight or time factor, as described above, to each operation in all areas or by actually assigning man-hours on a pro rata basis. In the latter case, detailed data on craft requirements could be developed.

Although the prime objective in staggering the work as described is to produce a smooth program, theoretically such practice permits flexibility in the scheduling of the various divisions of work and assignment of the proper sequential relationship. In addition, if material deliveries are kept in line with this planning, the right material will be available at the right time. Under realistic conditions, however, the sequence of work in various areas may be pretty well dictated by the anticipated material deliveries and the program therefore must necessarily be planned by taking advantage of certain early shipments and making compromises with the late ones, consistent with good construction practices, and by avoiding a too early start as previously explained.

Other factors . . . There are other matters that influence planning, such as availability and capability of construction equipment, utilities, sequence of heavy lifts, and so on. For example, if a derrick will be required to make five lifts that could be accomplished in 1 week, it would be wasteful to schedule these over a longer period, particularly if the equipment was needed at another location about the same time.

Weather Can Be Important

Assume that on a particular job an otherwise sound construction program would necessitate start of foundation work in January. However, cold weather conditions during that period would make it highly impractical and certainly expensive to pour concrete. Therefore rather than delay the start of construction until spring, it would be desirable to install foundations and underground work in the fall.

Subcontracting of foundation work would probably prove desirable since there would be no necessity for a full field office and supervisory staff during the early portion of the job. Of course, these situations must be anticipated well in advance and in this case, for example, the schedule would have to provide for early construction release of foundation drawings.

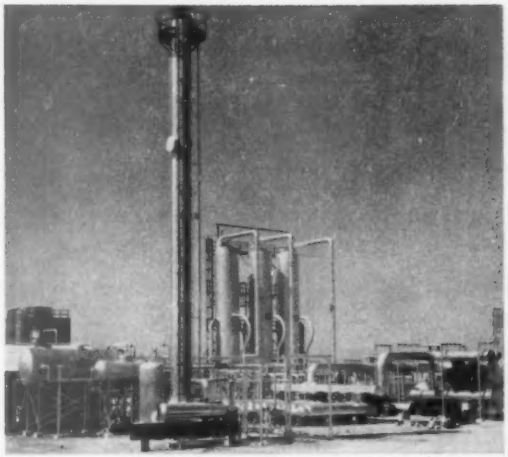
Where staggering is not possible . . . The staggering of work encompassing task areas has been mentioned and the logic behind such planning. However, there are some operations that just do not lend themselves to this treatment. Among these are the installation of underground piping and sewers, electric power lines, yard piping, instrumentation, and insulation. These tasks being rather general in nature usually involve the entire plot area and accordingly should be scheduled in proper relationship to other work on a broad basis. For example, to schedule the start and completion of instrumentation, the piping installation dates within each task area are referred to in order to determine start and completion of piping for the entire job. The broad schedule on instrumentation is then geared to these dates. Similarly, underground sewer lines are planned for installation concurrent with foundations in all areas.

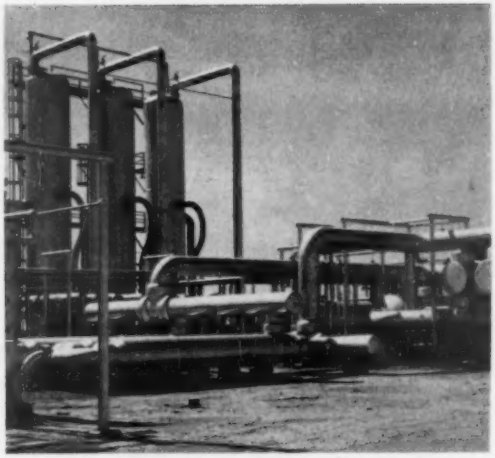
Expediting Material Deliveries

Assume that the entire job (engineering and construction) has been scheduled. The thoughts behind the "shipment required" dates represented by the Squared S symbol in Fig. 1, Part 1, will be described. Theoretically, each piece of equipment is required no sooner than the date installation is scheduled to start. However, since this would be impractical, for obvious reasons, the "required" date is scheduled with at least a little more lead time than will be required in transit from vendor to job site. In Fig. 1, Part 1, a month has been allowed but again this will depend on job location and how much safety factor is to be included.

"Required" date . . . Since there is nothing that contributes more to the failure of a construction schedule than delayed material deliveries, it is of utmost importance that those responsible for the requisitioning, purchasing, and expediting be kept continually aware of the required date for every last bit of material on the job. Probably the most effective method of execution is for this date to be applied directly to every requisition and purchase order **and corrected** if the occasion should arise.

Furthermore the time element should be a factor in placing a purchase order, although it is generally poor policy to divulge this information until such time as the bidder has given an estimate of delivery in his quotation. Any expediting that may be required subsequently should be aimed toward **maintaining**, not radically improving, the required date. By following this policy, effort can be concentrated on the materials that are really critical and relationships with vendors will be improved. Sincere but poor planning and haphazard or eager-beaver expediting has often caused shipments to be ready months prior to actual requirements. Future reliable delivery promises are not encouraged by such experiences.





PROCESSING EQUIPMENT at Northern Natural's Holcomb, Kans., gas-refrigeration plant includes, at left, forced-draft cooling tower and stabilizer. At right are shown three dehydration towers and propane chillers.

CONTRARY OPERATION

Gas Refrigeration Plant Designed to Extract Minimum of Natural Gasoline

Design prevents hydrocarbon condensate difficulties common to transmission of unstripped high-pressure gas, yet maintains maximum heating value of the gas

by R. B. McLaughlin and C. P. Stanley

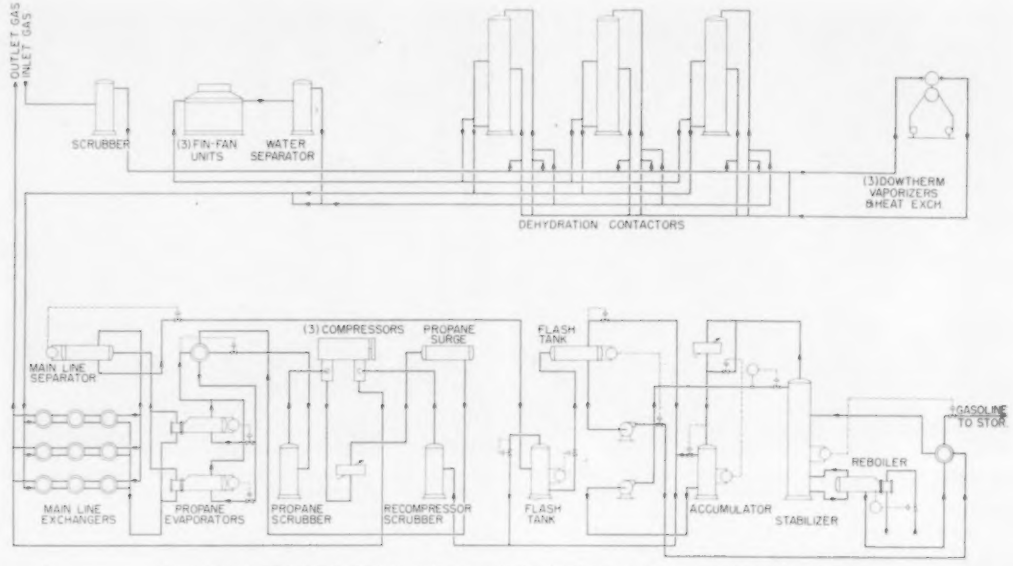
CONTRARY to usually accepted processing practice for modern gasoline plants, Northern Natural Gas Co. has a gas-refrigeration plant at Holcomb, Kans., designed and operated to extract a minimum of natural gasoline from 185 million cubic feet per day of Hugoton field gas. This operation prevents hydrocarbon condensate difficulties common to transmission of high-pressure gas without stripping, at the same time maintaining heating value of the gas at the maximum.

Design data . . . While this gas contains approximately 15 per cent nitrogen and is inherently rather lean, it contains enough heavy hydrocarbons to cause a considerable accumulation of condensate in pipe lines, particularly during winter months if it is not stripped. Since the gas contains only 0.15 gal. of pentanes and heavier per M.c.f., the installation of a conventional absorption and distillation system, including 900-psig. absorbers for 185 million cubic feet per day is disproportionally expensive for the production of 27,000 gal. per day of pentanes plus, which it would be possible to get.

After careful consideration of the low quantity of pentanes and heavier and the need to retain as much heating value as possible in the main gas stream, it was decided that the prudent approach to the problem would be direct refrigeration of the gas to remove the heavy hydrocarbons. By this method the plant could be coordinated with prevailing transmission-line operating temperatures and pressures, removing only enough gasoline to prevent condensate in the pipe lines.

In the case of Northern Natural, these pipe lines extend to the seasonally cold climate of Minnesota. Operating records over a number of years indicated that gas flowing temperatures of 30° to 34° F. could be expected on the northern portion of the transmission system. Prior to design of refrigeration plant, tests were made by means of a pilot refrigeration plant, which confirmed the belief that an appreciable amount of hydrocarbon condensation would occur under the predicted temperatures and pressures in the transmission pipe line.

Gas-refrigeration plant . . . This plant consists primarily of gas-to-gas heat exchangers, refrigerant evaporators, main-line separator, flash tanks, and fractionator to handle the gasoline condensate. The gas enters the gas exchangers from the solid desiccant dehydration plant at 850 psig. and 90° F., and is cooled to 32° F. in nine 30-in.-diameter exchangers arranged in three parallel banks. At this temperature the gas enters two 46-in.-diameter propane evaporators, operating in parallel, where it is further reduced in



SCHEMATIC FLOW DIAGRAM of Northern Natural's Holcomb, Kans., gas-refrigeration plant.

temperature to 20° F., and emerges approximately 98 per cent gas and 2 per cent liquid.

This mixture then enters a 6-ft. i.d. by 20-ft. horizontal separator where the liquid drops out for further processing. The stripped gas then reenters the gas exchangers and is heated from 20° to 76° F. by cooling the incoming gas. The total pressure drop through the refrigeration plant process is 8 psig.

The liquid hydrocarbons dropped out in the main-line separator at 20° F. and 850 psig. are first flashed at 400 psig., then at 200 psig., both without any additional heat required. The remaining liquid is pumped at approximately 0° F. through heat exchangers to the fractionating column, which is essentially a depropanizer, the kettle temperature being controlled to produce the desired grade of finished product.

The vapors from the two flash tanks and from the fractionator reflux accumulator are valuable from the standpoint of having a high B.t.u. value. These vapors are recompressed from 200 psig. to 850 psig. and reinjected into the main gas pipe line leaving the plant.

Gasoline recovery . . . This type of plant will produce approximately 20,000 gal. per day of 26-psi. R.v.p. gasoline as a byproduct while removing troublesome pipe-line condensate. The operating temperature of the refrigerant evaporators is adjusted to produce a hydrocarbon dew point in the stripped gas just below the seasonal gas flowing temperatures in the northern sections of the transmission pipe line.

The hydrocarbon dew points may, therefore, vary from 25° F. in cold weather to as much as 40° F. in the summer months. The heating value of the gas is thereby maintained at its maximum value, and there is no loss of pipe-line efficiency from hydrocarban condensate. Compressor-station maintenance costs arising from gasoline contamination are also eliminated.

The refrigeration and vapor recompression duty of this plant is handled by two 330-hp. vertical compressor engines, each having two compressor cylinders on refrigeration propane vapors and one compressor cylinder on vapor recompression service. The total horsepower required to compress the propane refrigerant single stage from 32 psig. to 170 psig. is 538. Seventy horsepower is required to compress the propane and lighter vapors from 190 psig. to 850 psig.

A single-cell induced-draft cooling tower is used to condense refrigeration propane and fractionator reflux in atmospheric sections. Air-fin cooling units are used to cool engine-jacket water and engine lubricating oil. One complete cooling unit powered by a 7.5-hp. electric motor is used for each engine. The only hydrocarbon pumps used are one each for fractionator feed and reflux with a common standby provided for both services.

Solid-desiccant dehydration . . . Since a large volume of this gas is distributed in the cold-climate area, it is deemed necessary to dehydrate the gas to a dew point of 0° F., or lower at all times. Dehydration is accomplished prior to the gas entering the refrigeration plant, in a solid-desiccant dehydration plant.

Three 7-ft. 6-in. i.d. by 42-ft. adsorbers are used, each adsorber containing four solid-desiccant beds each 8 ft. in depth. The vessel is divided

THE AUTHORS

R. McLAUGHLIN

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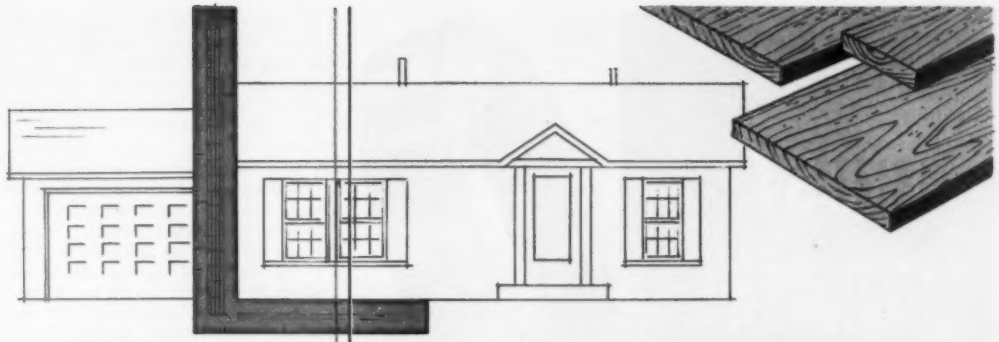
R. B. McLaughlin is process engineer for Northern Natural Gas Co. His entire working career of more than 30 years has been spent in the natural-gas and gasoline industries, in West Virginia, Oklahoma, Kansas, and Nebraska.

C. P. Stanley is chief engineer for Dresser Engineering Co., Tulsa, a position he has held since 1947. Previously he had been associated with Phillips Petroleum Co., at Borger, Tex., and at Oklahoma City and Bartlesville.



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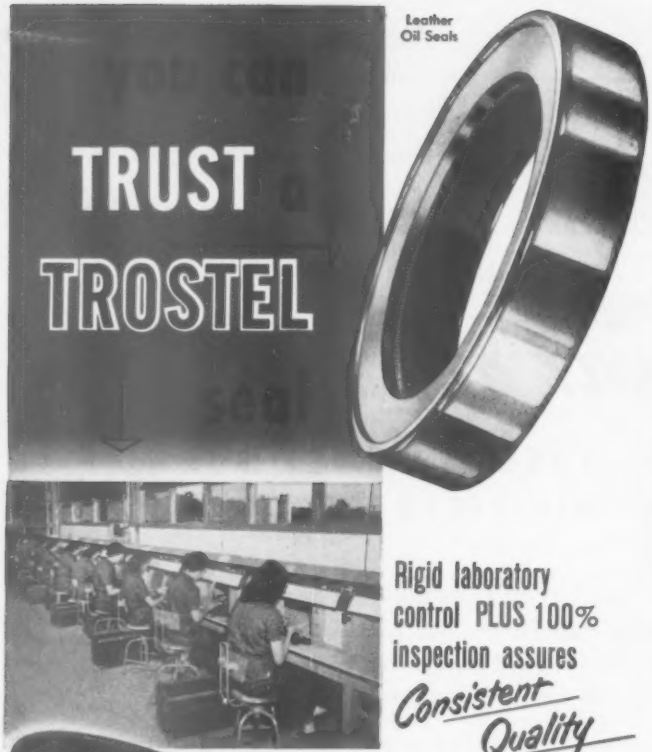

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into two halves by a diaphragm at the center with the top half and bottom half operating in parallel. The plant is operated with two adsorbers on active stream, one offstream for reactivation. The time required for the reactivation cycle is 8 hours.

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The adsorbers are reactivated at main-line working pressure by taking a small percentage of the inlet gas through the Dowtherm heat exchangers, thence through the adsorber being reactivated. From the adsorber the reactivating gas stream passes through air-fin coolers to a separator to remove the liquid condensate, then commingles with the main gas stream as it enters the adsorbers on stream. The pressure drop through the dehydration plant is approximately 3.5 psig.

Insulation practices . . . In order to minimize the heating and cooling loads, the adsorbers are insulated internally with 2-in. insulating material. A 16-gage steel liner is then placed against the 2-in. insulating material to support and protect it from deterioration. By installing the insulation on the inside of the vessel walls which are 2.65 in. thick, the heating and cooling of this steel is avoided, and thereby the reactivation gas volume is reduced to about 70 per cent of that required if the insulation were to be applied to the exterior.

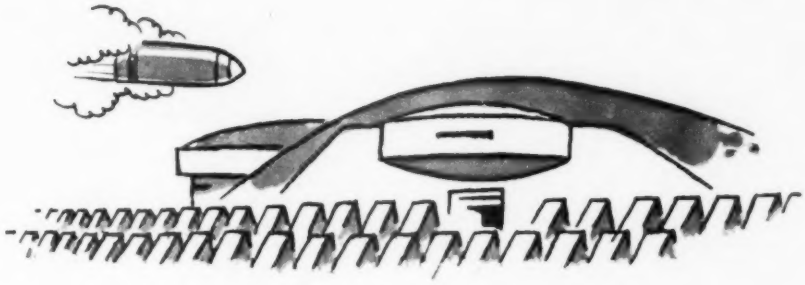
This gas dehydration and refrigeration plant was designed and constructed by Dresser Engineering Co. of Tulsa, from data developed by A. L. Vaughan, superintendent of compressor stations, Northern Natural Gas Co., and the coauthors.

BOOK

STANDARDS—ENGINEERING TOOLS FOR INDUSTRY. Published by American Standards Association, Inc., 70 East Forty-fifth Street, New York. 64 pp. $2.

This volume contains the proceedings of the Third National Standardization Conference held in conjunction with the Centennial of Engineering in Chicago last September. Combined with the proceedings in the booklet are the principal addresses presented at the A.S.A.'s thirty-fourth annual meeting award luncheon held in November in New York.

WALLS CHANGED.....



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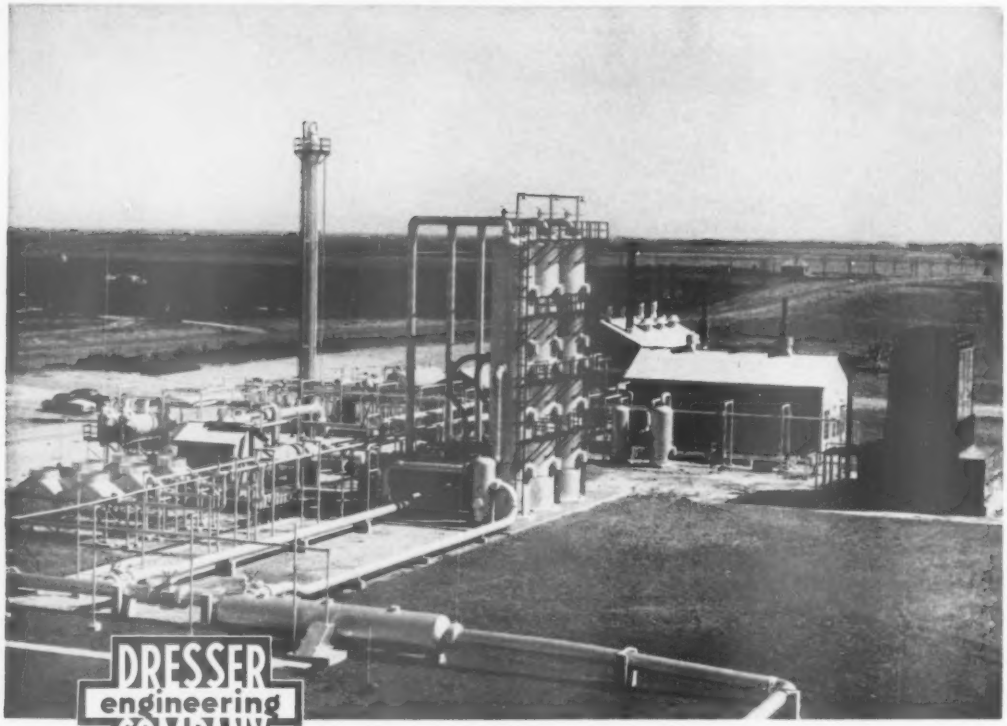

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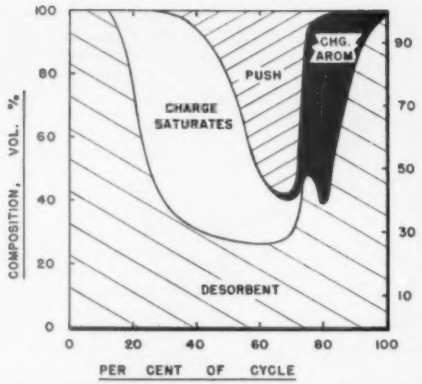

Fig. 1—Effluent diagram for a gel column already on stream.

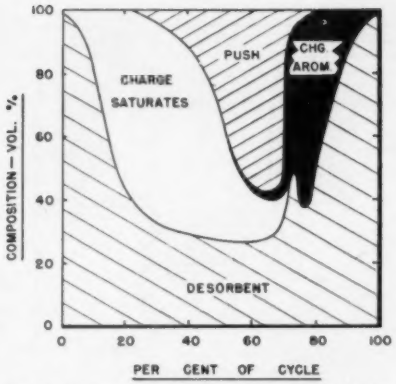

Fig. 2—Effluent diagram for a plant that is coming on stream.

PETROCHEM REPORT:

Separating Aromatics by the AROSORB PROCESS

. . . How this new separation process operates, charge stocks and products, commercial equipment

by F. R. Shuman*
and
D. G. Brace*

NITRATION toluene was the first pure aromatic produced in quantity from petroleum. The great expansion in refinery facilities for its production occurred during World War II. Since the chemical industry has been growing faster than its coal-tar benzene supply, a comparable expansion is now taking place in petroleum benzene plants. More recently the need for the individual xylene isomers has led to their isolation from petroleum.

At the same time specifications for high-volume solvents have been trending toward greater purity, both in the aromatic and the nonaromatic types.

Many processes have been tried for separation of these aromatic compounds in high purity. Methods that were developed for lube refining have been modified and new extraction processes have been developed. Most of these are at their best on one or two particular chemicals, and lose efficiency or ease of operation when used on other stocks. The Arosorb process, recently developed by Sun Oil Co., is equally applicable for materials ranging from benzene to aromatics in the gas-oil range.

*Sun Oil Co. Paper presented at regional W.P.R.A. meeting, Beaumont, Tex., February 12-13, 1953.

1. Process Principles

Essentially, the Arosorb process is a newly developed method for separating aromatic compounds from paraffins and naphthenes. Unlike other processes that do a similar job, the Arosorb process separates by using silica gel adsorption rather than extraction or azeotropic distillation. Silica gel has practically the same chemical composition as sand but it is synthesized in such a way as to produce particles consisting of myriads of tiny pores. As a consequence each particle has a tremendous surface area, something like 80 acres per pound. In addition to great surface area silica gel has the property of selectively holding chemical compounds on its surface. While the affinity for different molecular types varies widely, the Arosorb process utilizes the gel's much greater affinity for aromatic compounds over saturates.

Application . . . The method for applying this marked selectivity is simple. A feed stock is charged to a column packed with gel, and the amount of feed is regulated so that all the aromatics are retained by the gel. Then a saturate liquid such as pentane or butane is pumped into the column to displace feed stripped of aromatics. This saturate stream is referred to as the "push liquid" and constitutes the smallest portion of the cycle. After the aromatic-lean feed is displaced, the aromatics are recovered from the gel by washing with an aromatic liquid, called the desorbent, which boils outside the range of the feed. The cycle is then repeated. It is quite possible to remove the charge aromatics by using a paraffinic or naphthenic desorbent, but excessive amounts of these desorbents generally are required.

Effluent cycle . . . Assuming that the desorbent is an aromatic liquid, Fig. 1 illustrates the variation in gel column effluent during the cycle. This diagram represents a cycle for a gel column already on stream. At the beginning of this particular cycle the gel column is filled with desorbent from the preceding cycle. First the paraffins and naphthenes in the charge ("charge saturates") begin to come through, mixed with desorbent from the past cycle. The saturates reach a maximum, and taper off as the pentane push appears. The push reduces the charge material in the effluent down to a very small fraction. Next the charge aromatics come through sharply,

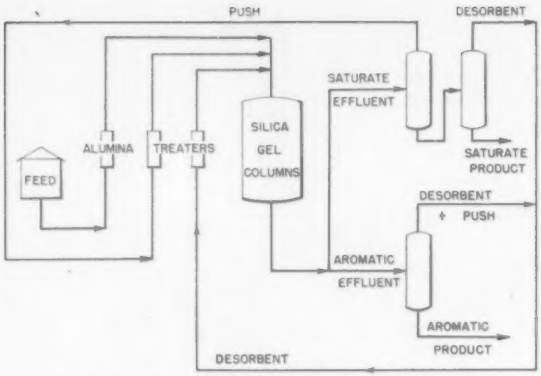

Fig. 3—Simplified flow sheet for commercial Arosorb unit.

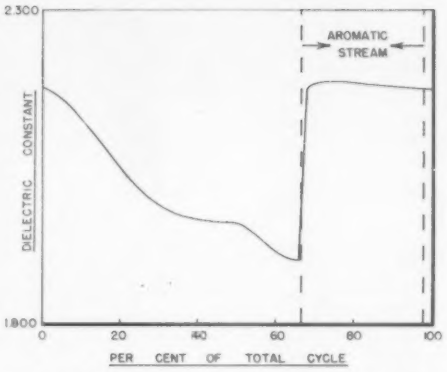

Fig. 5—Dielectric constant is plotted to aid in accurate switching.

slightly mixed wth pentane, then decrease until they, too, disappear leaving the effluent entirely desorbent.

Segregation of saturate and aromatic products is accomplished by splitting the effluent into two streams. The choice of points in the cycle for switching from saturate to aromatic tankage is set by product purity requirements.

Regardless of where the cut point from aromatic to saturate is made, both streams will contain a substantial amount of desorbent. The bulk of the pentane push liquid appears in the saturate stream, although a small quantity is present in the aromatic. In any case provision must be made for separating desorbent and push from both saturate and aromatic products by distillation.

Startup conditions . . . Generally, the relative size of the aromatic and saturate streams depends on the aromatic content of the feed stock. The cycle depicted by Fig. 1 is for the case where more desorbent has been added than is necessary. Consequently, the aromatic-to-saturate cut point is not critical, and the relative size of the two streams could be changed to suit. This is illustrative of a plant that is coming on stream. After the plant is lined out the desorbent is reduced to a minimum for economy. Then the effluent diagram looks like Fig. 2.

An analogous situation occurs with the push liquid. The amount of push is fixed to reduce the overlapping of charge saturates and aromatics to the minimum level. As with desorbent, more push would be used during plant startup.

2. Plant Practice

To translate the foregoing operations into commercial practice several auxiliaries must be added. Since silica gel has a far greater affinity for water than for hydrocarbons, water must be excluded by drying all streams entering the gel column. The simplified plant flow sheet, Fig. 3, shows alumina-type driers on the feed, desorbent and push streams. If, as a result of faulty separation, the gel does pick up enough water to substantially reduce its capacity for feed it may be regenerated by passing hot hydrocarbon vapors through the gel column.

The alumina driers also remove certain trace compounds from the feed which are so strongly adsorbed by silica gel that they act as poisons. For example, by pretreating a 300°-400° F. straightrun naphtha fraction with activated alumina before charging to the gel column, the effective life of the gel was increased from about 2 months to over a year.

Adsorption . . . After drying, the treated feed is pumped into the top of one or more silica gel columns, followed by push and desorbent. The time for charging each stream is fixed by a conventional cycle timer on each gel column. If several gel columns are used the cycles are staggered to smooth out the pumping load and to minimize variation in feed to the fractionation columns on the product streams. For a one-gel-column plant fractionation tower feeds can be smoothed by using two tanks in parallel on the saturate and aromatic lines, each large enough to hold one cycle.

Distillation . . . The sequence of distil-

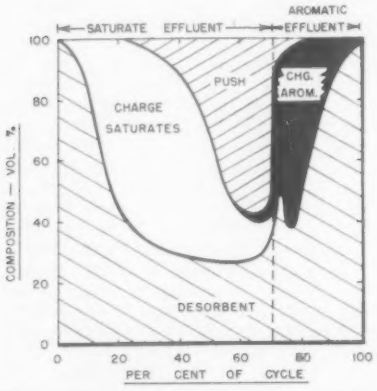

Fig. 4—Switching points in cycle must be accurately controlled.

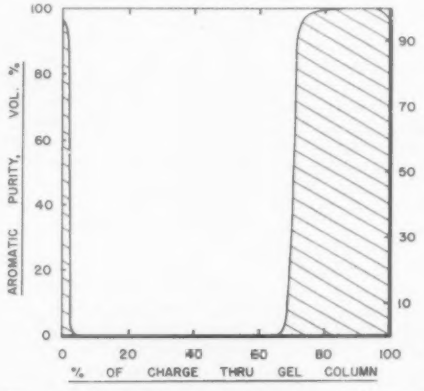

Fig. 6—Separation in gel column in terms of benzene purity.

lations following the gel column depends upon the type of feed stock being processed. The flow sheet, Fig. 3, is drawn for a plant running a 300°-400° F. naphtha, with benzene as desorbent and pentane as push. The aromatic effluent leaving the gel column is distilled to remove a benzene stream containing the small amount of push present. This slightly diluted benzene is satisfactory for desorbent and is taken as overhead product from the aromatic distillation tower.

Pentane push is recovered for rerunning as overhead from the first tower on the saturate side of the plant. Benzene desorbent is then separated from the saturate product in the second tower. Both benzene streams are combined for reuse as desorbent.

High-purity aromatics. For the production of these it is essential that no charge saturates be left in the returning desorbent. As shown by the effluent diagram, Fig. 2, the desorbent is approximately 70 per cent of the aromatic effluent. Thus, if the desorbent is contaminated by charge saturates to the extent of 0.5 per cent there will be a 1.2 per cent loss in aromatic purity. The same reasoning applies for good separation between aromatic product and desorbent if a low-aromatic-content saturate product is desired. Desorbent contamination is particularly important in the case of nitration-grade benzene manufacture, where the impurities must be under 1 per cent. In this case, high-saturate-purity normally also is required since high-saturate purity means high recovery of benzene.

Automatic cycle timer... As Fig. 4 illustrates, the points in the cycle at which the effluent is switched from aromatic to saturate and later back again must be closely controlled, particularly if the push liquid and desorbent are being held to a minimum. This accurate switching is accomplished by following the progress of the cycle with an instrument that measures the dielectric constant of the effluent. As the gel-column cycle progresses the instrument plots the dielectric constant, which passes through a sharp minimum, (see Fig. 5) just before the aromatic portion comes from the column. This minimum actuates a timer that controls the valves on the aromatic and saturate lines. Thus, the cycle time is automatically reset for each cycle.

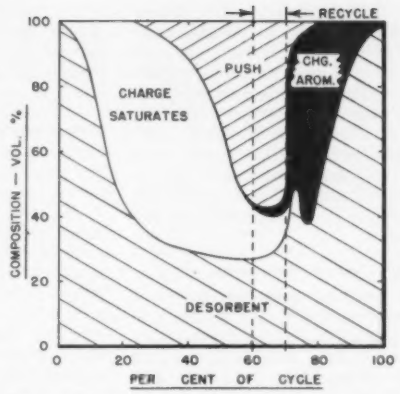

Fig. 7—Effluent diagram for case where recycle is employed.

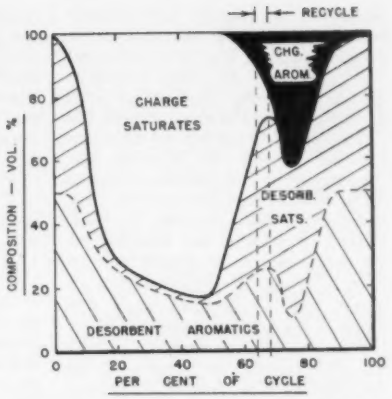

Fig. 8—Effluent diagram for cycle employing diluted desorbent.

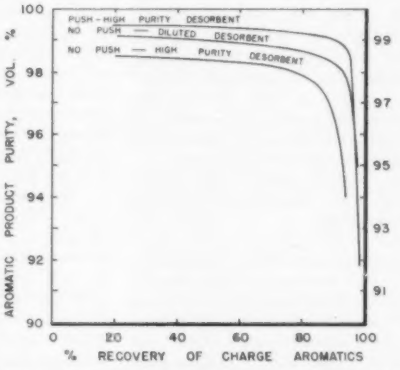
PUSH - HIGH PURITY DESORBENT
NO PUSH — DILUTED DESORBENT
NO PUSH — HIGH PURITY DESORBENT
AROMATIC PRODUCT PURITY, VOL. %
% RECOVERY OF CHARGE AROMATICS

Fig. 9—Comparing aromatic recovery at various purities with push, without push and with diluted desorbent.

3. Feed Stocks and Products

The choice of materials for push and desorbent, and the piping arrangements for the distillation section of the plant are determined by the proposed charge stocks. Push and desorbent should boil reasonably far from each other and from the feed to facilitate the eventual separations by distillation.

Distillation considerations impose one limitation on the three components of the gel cycle. Diffusion imposes another. For good separation, liquids entering a gel column should have a viscosity of not over 0.65 cp. This requirement necessitates operating at slightly elevated temperatures, or diluting certain high-viscosity charge stocks with pentane or butane. The list of suitable feed stocks is long. A few representative ones will be discussed.

Benzene Reformate

The lowest-boiling charge that would run in an Arosorb plant for aromatics would be a catalytic reformate containing benzene, boiling between 140° and 190° F. The benzene content might be about 35 per cent, and for a nitration-grade product the finished benzene must be of at least 99 per cent purity.

Benzene purity... Fig. 6 illustrates the separation that occurs in the gel column in terms of benzene purity. This graph represents the results of distilling push and desorbent from cuts taken through a complete cycle, and analyzing the charge fraction for benzene content. Benzene purity was then plotted against per cent of total feed per cycle to give a true picture of the amount of high-purity benzene that can be expected from each cycle after distillation. If the cut points are made properly benzene of as high as 99.6 per cent purity can be produced. In actual operation the plant would be started up taking just such a narrow cut for the aromatic effluent. After the plant was lined-out, the width of the aromatic fraction gradually would be broadened until the lowest desirable purity and the maximum recovery were reached.

Recycling... Since benzene is a relatively high-priced product, high recovery is important. The possibility of

employing a recycle has probably become apparent. Another look at the effluent diagram, Fig. 7, will illustrate the point. The recycling is accomplished by adding another cut point to the cycle, and a third effluent line is needed to permit mixing this intermediate cut with the incoming feed. The recycle stream contains aromatics from both the feed and desorbent, and reduces the plant capacity for fresh charge by about 15 per cent depending on the quantity of effluent recycled.

Through recycle a high benzene recovery can be obtained along with extreme purity. For example, with no recycle the possible recovery of 99.4 per cent benzene is 75 per cent, but by recycling 9 per cent of the effluent the recovery becomes 92 per cent.

An interesting sidelight on recycle is that when charging benzene reformate containing 1 per cent olefins, the olefins build up in the recycle stream to the extent of 3 per cent. Then they begin to go out of the plant in the saturate product. As a result, the Arosorb process produces a benzene low in olefins. This minimizes the amount of subsequent treating required to pass the acid wash color test.

Desorbent . . . The Arosorb processing of a benzene-containing stock can best be done with a xylene stream as the desorbent. Xylenes are low in viscosity, high enough in boiling point to make distillation simple, and in adsorbability, close to that for benzene. The latter is desirable for optimum results.

Push liquid . . . Butane is probably the best push liquid for benzene-containing feeds. The fact that the xylene desorbent and butane push boil on opposite sides of the charge requires that another distillation tower be added to the three in the plant previously described. The extra tower removes push liquid which would throw off the benzene boiling range. By including this fourth tower the boiling range of the benzene product can be controlled very accurately since both initial and end point are fixed by separate fractionators. The overhead from this fourth tower is recycled to feed to recovery any benzene carried over with the push.

When extremely high purity is not needed, push liquid may be eliminated from benzene processing as will be shown later.

Toluene Purification

The next higher boiling aromatic that may be purified to reagent grade by the Arosorb process is toluene.

The requirements for running a toluene feed are generally the same as benzene. The boiling points of toluene (231° F.) and xylenes are closer than desirable. For this reason a higher-boiling aromatic fraction such as obtained from a 340°-400° F. naphtha would be selected for desorbent. Since the viscosity of these aromatics is higher than desired at room temperature, the gel column would be operated at 130° F. to reduce the viscosity to 0.65 cp.

Xylene Reformate

The next higher-boiling group of aromatics currently in demand as chemicals are ethyl benzene and the xylenes, boiling between 277° and 292° F. Although they can be produced in 95 per cent purity by careful fractionation before and after a catalytic reforming operation, about half the potential xylenes are lost by this method. If the reformer feed is cut high enough to include the natural xylenes, as well as xylene-forming naphthenes, the reformate product should contain at least 40 per cent aromatics, thus making an ideal feed for an Arosorb plant. This method of operation eliminates much of the distillation load in xylene production, since reformer feed cut points then are not critical.

High purity . . . By using benzene desorbent the xylene operation in the Arosorb plant becomes the reverse of running a benzene-bearing reformate. The xylene product can readily be purified to 99 per cent, making a good starting material for separation into xylene isomers of high purity. The olefin content will be low. Since the push liquid, again either butane or pentane, and the benzene desorbent will boil below the xylenes only three distillation columns will be required. The push and desorbent would then be taken overhead in the aromatic and saturate towers. Push would be split out from the saturate overhead in a third tower.

Benzene, toluene, and xylenes are all presently needed as high-purity chemicals. Although substantially 100 per cent purity can be reached by diluting the charge saturates as is done in some other aromatic purification processes, these aromatics can be Arosorb processes to well above 99 per cent purity without recourse to this complication.

300°-400° F. Straightrun Naphtha

Beyond the xylene-boiling range the number of aromatic compounds becomes so numerous that separation of individual compounds is largely precluded. These higher-boiling materials are normally used for solvent purposes only. As solvents the maximum purity usually needed is about 95 per cent and boiling-range limits are frequently nominal. Consequently, processing such a feed is less expensive.

High-solvency product . . . A typical charge for solvent manufacture is a 300°-400° F. straightrun naphtha. Its aromatic content will vary from 15 to 30 per cent depending on the crude source. High-solvency slow-drying aromatic solvents and low-odor slow-drying saturate solvents result from gel processing of such feeds. The aromatic solvent, if made to 95 per cent aromatics, has a Kauri-Butanol solvency of 94, compared with 38 for a naphtha feed containing 17 per cent aromatics.

The saturate product can be produced with less than a 1 per cent aromatic content. At that level the odor that remains is due to presence of naphthenes and consequently is distinctly different from the original both in degree and type. The solvency of these saturates is somewhat better than pure paraffinic solvent. If low-odor saturate product is required, a feed having a 340° F. initial boiling point is suggested.

Regardless of whether the 300°-400° F. charge to the Arosorber is high or low in aromatic content the processing is about the same. Since the viscosity of such a charge stock is just over the 0.65-cp. limit for efficient gel separation, either the feed must be diluted with push liquid or the gel column must be operated at about 130° F. There is little difference in distillation requirements since 130° F. operation reduces the gel capacity for feed to about the same extent so that the push-plus-desorbent load per barrel of feed for the 130° F. operation equals that for diluted feed. Choice depends on local conditions.

As with xylene feed, benzene is the preferable desorbent, and again only three distillation columns are needed. Distillation loads are small, a result of the 120° F. spread between charge stocks and desorbent.

Kerosine

There are two ways to process kerosine. It can be run to give a good split between aromatics and saturates, producing a very slow-drying aromatic solvent of higher solvency than the 300°-400° F. cut, and a very slow-drying saturate solvent of low odor. On the other hand it can be processed to segregate only a part of the aromatics. These aromatics would be of high purity, and again be of very slow-drying high-solvency type. The saturates, representing possibly 90 per

cent of the original kerosine would be sold for low-smoke lamp oil. This second type operation allows for high charge throughput for a given amount of solvent recovery.

Kerosine has too high a viscosity to process undiluted, even at 150° F. The feed to the Arosorb plant must then be diluted with about 35 per cent pentane.

Recycle Catalytic Gas Oil

Recycle catalytic gas oil also offers two interesting systems of processing. If run for good separation and high-purity products the saturate fraction becomes an unusual diesel fuel with a 70 cetane number. Typically this product can be blended one part to two of the feed gas oil to make a 50-cetane fuel. The aromatic product concurrently made is suitable as an insecticide solvent.

The other alternative treatment for cycle stock is to remove only a small portion of the aromatics. A number of solvent-extraction procedures have been applied to cycle stock to reduce the coking tendency in the second cracking pass. The principle is to reduce the dicyclic aromatics that are detrimental from a carbon-forming standpoint. The high selectivity of silica gel can be used for this operation. For the same coke make the gasoline yield upon catalytic cracking is appreciably increased by the gel treatment. Since only small amounts of aromatics need be removed the fresh charge to the gel case is adjusted to give a low desorbent-to-charge ratio, and therefore an economical operation.

4. Process Economics

The fundamentals of the Arosorb process and several possible feed stocks have been discussed. Much of what has been said applies to making reagent-grade aromatics. Where lower purity is practical both operating and investment costs can be materially reduced.

The major expense in investment and operating costs of an Arosorb plant is the distillation facilities. The Arosorb process is analogous to solvent extraction, with the combination of gel and desorbent acting as an extremely selective solvent. As in extraction plants the big cost is solvent recovery, the solvent in an Arosorber being desorbent and push. This has been the point of attack toward a more efficient process.

Elimination of Push Liquid

The most important change that has been made in the original aromatic-desorbent push operation is the elimination of push. This has been accomplished by using a desorbent of relatively low aromatic content, say 65 per cent. As the desorbent flows through the gel column it is separated, in effect, into aromatic-rich and saturate-rich fractions. The more saturate part of the desorbent acts as push, displacing the charge saturates from the gel column before desorption of the feed aromatics begins. Fig. 8 is an effluent diagram for a cycle employing diluted desorbent. Notice the low aromatic content of the desorbent following the saturate part of the cycle. That a saturate-rich fraction is necessary is shown by Fig. 9 which compares the aromatic recovery at various purities for cycles with push, without push, and with diluted desorbent. No recycle was used in this study in order to magnify the differences. The curves illustrate the comparative aromatic recoveries at various product purities. This plot demonstrates that maximum aromatic purity is achieved with push. If 99.2 per cent product purity is enough, desorbent dilution is sufficiently effective.

When push is replaced by diluent desorbent, the desorbent amount is increased by an amount equivalent to the push it replaces. However, the net effect is the elimination of one large distillation tower that would otherwise be required to recover push. If less than nitration purity is acceptable in a benzene or toluene operation diluted desorbent eliminates two distillations.

Reduction in distillation load occurs as purity-recovery requirements are decreased. As has been mentioned, when only a portion of the charge aromatics need be removed the amount of fresh feed per cycle can be increased considerably for the same amount of desorbent. A similar reduction in distillation load occurs with any substantial reduction in charge aromatic content. Gel capacity for fresh feed is largely limited by its capacity for aromatics.

Choice of Operations

The choice among various operating schemes hinges on the feeds that are to be processed and the products that are desired. The reduction in push and desorbent solvent recovery requirements with decreased purity-recovery is illustrated by Table 1. Reagent-grade aromatics require push, desorbent, and recycle whereas a purity level of 98-99 per cent would be reached merely with diluted desorbent and recycle. Producing solvent-grade aromatics eliminates the need for both push and recycle, but uses diluted desorbent. Partial dearomatization requires only aromatic desorbent, which should be about 95 per cent aromatic to minimize the desorbent amount required.

Table 1 further illustrates that even for reagent-grade products, such as nitration-grade aromatics, the ratio of solvent to charge is substantially independent of feed boiling range up to the point where viscosity becomes a major factor.

Equipment design . . . Distillation and drying equipment for an Arosorb plant are of conventional design. The gel columns are more unusual, and require different construciton from an alumina drier, for example. Whether one or more will be needed can be estimated by assuming that the cross-sectional area should be sized to give a fresh charge rate of about 0.4 g.p.m. fresh feed per square foot, so that a 500-bbl. per day plant would require two cases 5 ft. in diameter. The height should be about 20 ft., giving a gel inventory of 34,000 lb.

Processing costs . . . Roughly, the operating costs for an Arosorb plant range from 1 to 3 cents per gallon of charge, again depending on the type of feed and products.

The installation of an Arosorb plant gives the refiner a most versatile unit for purification of aromatics. It will allow him to process any boiling range from benzene to gas oil with high purity for both saturate and aromatic products as desired.

References

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W. H. Davis, J. I. Harper, and E. R. Weatherly, "Arosorb Process . . . a New Refinery Tool," The Oil and Gas Journal, May 19, 1952, page 113.

R. M. Love and R. F. Pfennig, "Aromatics From Petroleum," pp. 299-309, in Advances in Petroleum Technology, American Chemical Society, 1951.

TABLE 1—BARRELS SOLVENT* PER BARREL CHARGE

Charge stock	Reagent purity 95 per cent recovery	High purity 95 per cent recovery	Solvent purity 90 per cent recovery	Partial Dearomat.
Benzene reformate	2.9	2.2	..	..
Toluene reformate	3.1	2.3	..	..
Xylene reformate	3.3	2.4	..	..
300°-400° F. Naphtha	..	1.1	0.8	..
Kerosine	..	..	1.2	0.7
450°-600° F. cat. gas oil	..	..	3.1	1.8

*Solvent = push + desorbent.

Daily Well Progress Report

Well Name
Rig No. 21
Operator
County Lea State New Mexico
Well Depth 11,750'
Contract Footage Depth 10,000'
Day Rate
Daily Rig Cost Estimate
Estimated Operating Days
(1) Payroll 69 (2) Drilling 65

Arrow Drilling Company ☑
Arrow Drilling Company of Texas ☐
District "B"
Pusher
Date Operations Started
Date Operations Completed

Month	Day	Depth	Footage	Revenue	Drilling Days	Bits	Remarks
8	3	6914	712		37		3/4°
8	4	7016	102		38		
7	14	4268	–		17		Drill Cement
7	24	5536	172		27		
8	5	7142	126		39		
7	15	4268	–		18		Drill Cement
7	25	5660	124		28		Lime
8	6	7245	103		40		

STREAMLINED PROGRESS CONTROL is afforded by this daily well-progress report used on all operations of Arrow Drilling Co. of Tulsa and its affiliated companies. (Fig. 2.)

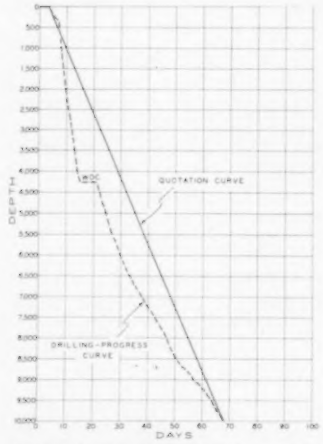
COST WATCHDOG

Daily Progress Record Aids Contractor

by Joseph A. Kornfeld
Mid-Continent District Editor

A DAILY check on profitability vs. performance is made in each of the 24 rigs operated by Arrow Drilling Co., of Tulsa, and its affiliated companies, Arrow Drilling Co. of Texas, and Arrow Drilling Co. of Canada, Ltd. Utility lies in the comparison of two penetration curves in Fig. 1.

The straight-line curve at the right in this illustration (shown in dashed lines) represents the maximum number of payroll days which may be reached at a given depth.



DRILLING PERFORMANCE is correlated against the quotation curve. (Fig. 1.)

The jagged curve at the left (shown in a solid line) making the course of the well's progress, is represented in the plot of **depth** vs. **total payroll days.** A practical comparison is made by noting the position of the **well-progress line** (corrected by subtracting day-work days such as drill-stem testing, coring, and the like) against the straight-line quotation or **cost line.** As long as the well-progress line remains to the left of the profit line, the contractor is showing a profit on the particular well analyzed.

Preparing the bid . . . The daily rig-cost estimate is obtained by calculating the number of payroll days required to drill a well to the contract depth anticipated; this time includes rigging up, rigging down, waiting on cement, and actual drilling to contract depth. This estimate is translated into cost of payroll days based on current labor costs. In addition, the cost of bits (obtained from offset-well experience) is added to the cost.

Thus the quotation bid is translated into a **depth** vs. **total payroll days** curve and thus is used as a check on profitability, although the straight-line relationship shown in Fig. 1 by the quotation curve does not follow the actual shape of a normal penetration curve.

Tabulating the data . . . Preparation of the **drilling-progress curve** is simplified by use of the form shown in Fig. 2. The daily letter prepared by a tool pusher is sent to one of the district offices at Tulsa, Tyler, and Dallas. It carries the following information: today's depth, footage cut today, formation, and bore-hole deviation. This information is transferred to the proper calendar-day position in Fig. 2.

Revenue control . . . A refinement of this form may be made by subdividing the **revenue** rectangle into four divisions:

1. Daily cost of operating rig.
2. Daily income: footage drilled today times quoted footage rates.
3. Daily drilling profit. (Column 2 minus Column 1.)
4. Cumulative profit to date.

W. S. Churchill, president of Arrow Drilling Co., is the originator of the form. I. H. Patton, Jr., is executive vice president of the company.

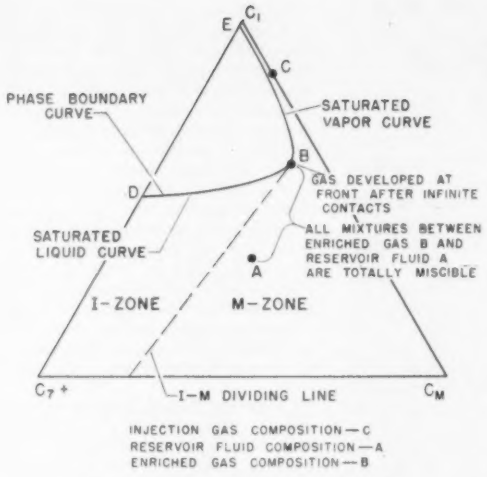


Fig. 7—Illustration of M-zone displacement.

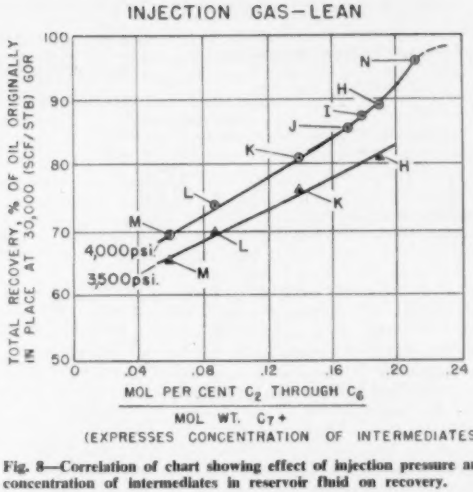


Fig. 8—Correlation of chart showing effect of injection pressure and concentration of intermediates in reservoir fluid on recovery.

"I" Type or "M" Type

(Continued from page 88)

saturated fluid displacement at 3,000 psi.) increased the virgin oil recovery from 20 to 40 per cent in the hypothetical example shown in Table 3. The effects of undersaturation on recovery are illustrated by comparing virgin oil recoveries from the 3,000-psi. saturated displacement (Case II) with the 3,000-psi. undersaturated displacement (Case III). The formation-volume factor effect resulted in 52.1 per cent of oil in place being produced at breakthrough in Case III, compared to only 40 per cent for Case II in which no swelling effects occurred (displacement efficiency assumed to be the same in both cases as a result of equal interfacial viscosity ratios).

(f) Experimental results . . . Experimental recoveries resulting from high-pressure Type I displacements involving two reservoir fluids and the three porous media (relative permeability ratios shown in Fig. 6) are presented in Table 4. The importance of undersaturation (or formation volume factor effect) is illustrated in the displacement of reservoir fluid G (composition given in Table 5).

Increasing the injection pressure leads to higher recoveries from the swelling and interfacial viscosity effects discussed previously. Focusing attention on the displacement of reservoir fluid G by lean gas from an unconsolidated sand core, virgin oil recovery (recovery before gas-oil-ratio rise) was increased from 23.5 per cent of the oil in place to 62.1 per cent by increasing the injection pressure from 1,000 psi. to 3,700 psi. (rows 1 and 4 in Table 4). Ultimate recovery increased from 58.5 to 85 per cent at these respective pressures.

Similar effects were noted in displacements involving reservoir fluid H (composition listed in Table 5), in which virgin oil recovery was increased from 48.8 to 62.6 per cent by increasing the injection pressure from 2,900 psi. to 3,500 psi. Ultimate recovery increased from 67.2 to 77.6 per cent at these respective pressures (see rows 5 and 6 of Table 4).

Undersaturation effects on recovery are further emphasized by comparing results involving displacements of reservoir fluids G (800-psi. bubble point) and H (2,760-psi. bubble point) at 2,900 psi. from the unconsolidated sand core (rows 3 and 5, Table 4). The virgin oil recovery obtained in the highly undersaturated case (fluid G) was 57.1 per cent compared to only 48.8 per cent for the essentially saturated case (fluid H). This effect was further illustrated in displacement involving a different porous medium type (rows 9 and 11 of Table 4).

Effect of porous medium type on recovery is illustrated by comparing the displacement results obtained at 3,500 psi. in three different cores (rows 6, 8, and 10 of Table 4). Virgin oil recovery ranged from 62.6 per cent in the unconsolidated sand core, to 46.5 per cent in the Torpedo core, and to 40.1 per cent in the Bandera core. Rows 5, 7, and 9 indicate similar trends for 2,900-psi. displacements.

These same trends in recovery were predicted from the results of the modified Buckley-Leverett calculations. Virgin oil recoveries predicted by this method, however, were in rather poor agreement with those observed. This result was expected because the theoretical calculations do not take into account the effect of fingering and channeling, factors leading to earlier breakthroughs.

Displacement Mechanism Describing Type M Case

(a) Schematic mechanism representation . . . The displacement mechanism for a high-pressure gas drive in which the displacing phase is enriched and becomes miscible with the reservoir fluid at the front is basically that of one miscible phase displacing another, such as light oil displacing a heavy oil. Such a displacement (Type M) generally yields significantly higher ultimate recoveries than the Type I case discussed previously.

The high efficiency is the result of displacing essentially all of the oil in the area contacted except for bypassed islands of oil which are large compared to a pore space. Even this bypassed oil continues to flow as long as it is surrounded by material miscible with it. The schematic representation in Fig. 2 is presented to show what happens to this bypassed oil in the Type M case. Except for the bypassed material shown, there is no other residual oil in the area contacted.

(b) Type M, in terms of triangular diagram . . . The importance of the phase relations in the Type M displacement can be seen in Fig. 7. Initially, gas of composition C is injected into reservoir fluid A. Because a line between A and C intersects the phase boundary curve (EBD), these two phases are not miscible.

After numerous contacts, however,

TABLE 6—MISCIBLE PHASE DISPLACEMENTS IN LABORATORY CORES.

NAPHTHA-PENTANE SYSTEM $\frac{\mu \text{ DISPLACED PHASE}}{\mu \text{ DISPLACING PHASE}} = 2.3$

Core—	Stock-tank oil produced, per cent of oil in place: Virgin	After injecting 1 pore vol. of displacing phase	Flowing ratio, Displacing/displaced, cc./cc.	Pressure drop, psi. per ft.
Unconsolidated sand (23 ft.)	71.6	90.5	2.3 at 1 pore vol.	3.2
Torpedo sandstone (10 ft.)	75.5	92.0	2.1 at 1 pore vol.	6.0
Bandera (f ft.)	74.0	88.0	2.5 at 1 pore vol.	100

gas C becomes enriched and reaches the critical composition B. This enriched material is miscible in all proportions with reservoir fluid A. In fact, material B is miscible with any reservoir fluid lying to the right of the I-M boundary in Fig. 7. It follows, therefore, that a Type M displacement is possible whenever the reservoir fluid contains sufficient intermediates to place its composition to the right of the I-M boundary. By virtue of these intermediates the injected gas may become enriched to produce a gas phase which is miscible with the original reservoir fluid.

(c) Experimental evidence . . . The concept has been expressed that the flow characteristics (relative permeability) of the porous medium are of only minor importance in predicting the recovery efficiency when displacing oil by a phase miscible with it. That is, the effects of capillarity are practically eliminated when miscibility is achieved, because no interfaces exist in the capillary openings.

Experimental evidence on the displacement of naphtha by pentane [(viscosity, naphtha) / (viscosity, pentane) = 2.3] in three different porous media (unconsolidated sand, Torpedo sandstone, and Bandera sandstone) (Table 6) show about the same high recovery (74 per cent) for all three cores when run at comparable rates. These results, of course, indicate that the nature of the porous medium is not very important in such a displacement.

The partial "wiping out" of the importance of the porous medium is also shown by the data in Table 7 containing a summary of the results of a number of high-pressure runs where one type of reservoir fluid (H) was displaced by lean gas in the same three samples of porous media. These data show that at 4,000 psi. (Type M case) the production prior to any increase in gas-oil ratio is 50.4, 56, and 56 per cent, respectively, for runs 1, 2, and 3. The total production for these same runs shows about the same spread, viz., 77, 78.6, and 82.3 per cent production.

The data in Table 7 also show the effect of the flow path length on laboratory recoveries. Looking at just one porous medium (unconsolidated sand), the production prior to any increase in gas-oil ratio goes from 56 to 67.5 to 82 per cent as the length of the core increases from 6 to 23 to 123 ft., respectively. The total recovery for these same three experiments was 82.3, 87.5, and 95 per cent. No such effects of length, however, were observed in Type I displacements in the same porous medium.

For 20-ft. and 123-ft. cores, the production prior to gas-oil-ratio rise was 49 per cent and 52 per cent, respectively. Ultimate production for both cores (20-ft. and 123-ft.) was approximately 67 per cent. This result is consistent with the Buckley-Leverett analysis.

These laboratory recovery numbers for production at gas-oil-ratio rise must be revised upward, however, to give a proper measure of the displacement efficiency because of fingering and channeling which allow the displacing fluid to reach the end of the core prematurely. A run made with five separate 23-ft. core sections connected by capillary tubing was carried out to minimize the effects of channeling and fingering by deliberately mixing the components in the flowing stream between each core section. The results of this test (Table 7) gave the highest recovery observed, viz., 88.2 per cent recovered at gas-oil ratio rise, as compared with only 82 per cent in the 123-ft. core, and 67.5 per cent in the 23-ft. core. This result was interpreted to mean that the true displacement efficiency approaches 100 per cent of the portion of the reservoir contacted in the M-zone displacement.

(d) Reservoir factors, Type M displacement . . . From the foregoing it appears that theoretically, in a uniform matrix with no fingering or channeling, close to 100 per cent of the oil in place would be produced at breakthrough of the invading phase in a miscible phase displacement because of (1) the absence of capillary blockage effects, and (2) the absence of relative permeability effects.* Some consideration must be given, however, to reservoir factors such as fingering, channeling, and the sweepout pattern which act to prevent the contacting of 100 per cent of the reservoir volume.

In practice, therefore, less than 100 per cent of the oil in place is produced in miscible phase displacements. For

*M. Muskat at a recent meeting mentioned the relationship between miscibility and high recovery. An abstract of his remarks follows:[7]

The controlling physical factors limiting oil recovery today, according to Morris Muskat of Gulf Oil Corp., Pittsburgh, are immiscibility between the displacing and displaced fluid phases in a reservoir, and the associated interfacial forces. If these limiting factors were removed, substantially 100 per cent recovery of oil might be achieved, provided that a higher crude price and other favorable conditions existed.

Possibilities include retrograde vaporization of crude by high-pressure gas injection, flooding with miscible hydrocarbons or with water treated to remove the interfacial tension with oil, and underground volatilization of crude oil.

TABLE 7—PRODUCTION HISTORY RESULTING FROM TYPE M DISPLACEMENTS OF RESERVOIR FLUID H, BY LEAN GAS FROM LABORATORY CORES

Core—	Core length, ft.	Injection pressure, psi.	Stock-tank oil produced at various stages of the process, per cent of oil in place originally: Prior to gas-oil ratio rise	Transition*	Final stage†	Total recovery	Blowdown	Residue	No. of pore vol. of gas injected
Torpedo sandstone	10	4,000	50.4	7.5	19.2	77.1	2.9	20.0	1.40
Bandera outcrop	5	4,000	56.0	6.0	16.6	78.6	1.8	19.6	1.53
Unconsolidated sand	6	4,000	56.0	15.7	10.6	82.3	2.9	14.8	1.19
Unconsolidated sand	23	4,000	67.5	11.7	8.3	87.5	1.9	10.6	1.00
Unconsolidated sand	123	4,000	82.0	4.4	8.6	95.0	0.6	4.4	1.05
Unconsolidated sand	‡115	4,000	88.2	4.0	3.3	95.5	0	4.5	1.00

*Production observed in interval between gas-oil ratio rise and appearance of free-gas phase in the high-pressure effluent. †Production observed in interval between appearance of free gas and abandonment gas-oil ratio of 30,000 standard cu. ft. per stock-tank bbl. ‡115-ft. core formed from five essentially equal-length cores joined in series by small tubing.

example, observation of miscible phase displacements using the X-ray tracer technique[5] in small-scale experiments shows that the invading phase fingers into the displaced phase, resulting in reservoir contact efficiencies less than 100 per cent in most cases. As might be expected, the reservoir contact efficiency is a function of the viscosity ratio (viscosity displaced)/(viscosity displacing), the more severe fingering being associated with the unfavorable viscosity ratios, particularly those in excess of 3 to 1. A second factor contributing to lower breakthrough recovery, which is much smaller in its effect, is caused by a small mixing zone at the front of the invading phase (attributed to nonequilibrium conditions at the front).

It is well to emphasize at this point that in attempting to achieve miscibility between injected gas and reservoir fluid, no effort is being made to produce a system in which all of the gas is miscible with the reservoir fluid as has been suggested by others,[7] but merely to achieve miscibility at the front between enriched gas and reservoir oil.

Field Application of High-Pressure Gas Injection

Considerable information is required to evaluate the applicability of high-pressure gas injection to a specific reservoir. In addition to the usual factors such as shape of reservoir, thickness, porosity, permeability, relative permeability, connate water, in-place oil, etc., information is needed on the composition of reservoir fluid and injected gas, reservoir temperature, and unusual reservoir characteristics which may lead to channeling.

PVT studies should also be carried out to establish the general nature of the triangular diagram such as shown in Fig. 3. With these data and a basic understanding of the process, the recovery expected at various injection pressures can be estimated. Laboratory displacement studies simulating reservoir conditions are obviously of tremendous help in arriving at a reliable estimate of the recovery efficiency.

Efficiency of oil displacement by high-pressure gas in laboratory studies for a number of different reservoir fluids has been determined at two pressures. The fluid compositions are given in Table 5. The ratio, mol per cent of C_2 through C_6 to the molecular weight of the C_7+ fraction, was selected as a reasonable correlating factor, and this value for each fluid is given in the table. The quality of this ratio as a correlating factor is demonstrated in Fig. 8 where the total recovery observed in long-core displacement experiments at 3,500 and 4,000 psi. is plotted against the ratio (mol per cent C_2 through C_6)/(mol weight C_7+). Where direct experimental evidence is not available on a given system, this correlation is extremely valuable.

Block 31 project . . . To illustrate the differences to be expected in an actual reservoir between recoveries by Type M and Type I displacements—compared also to water drive and to natural depletion—an analysis of the expected behavior of University Block 31 field, Crane County, Texas, is given. The part played by the reservoir rock (relative permeability, channeling, etc.), the role of the reservoir fluid (viscosity, concentration of intermediates, FVF, etc.), and the effect of well pattern and mobility ratio have been considered.

The various processes were analyzed in terms of the unit displacement efficiency (per cent of oil in place displaced from the portion of the reservoir contacted by the displacing phase) and the fraction of the reservoir **actually** contacted or swept by the displacing phase. The calculated recovery, therefore, is the product of the unit displacement efficiency times the fraction of the volume swept. In an actual reservoir, to obtain the correct volume of the reservoir contacted, the sweepout pattern efficiency is multiplied by a factor to allow for channeling.

The details of the University Block 31 injection program have been described as in earlier paper,[6] and are summarized in Table 1. The sweepout pattern efficiency on the basis of an approximate nine-spot pattern is 77 per cent for the 3,500-psi. Type I displacement. A channeling factor of 80 per cent was applied to recovery calculations to allow for reservoir inhomogeneities. The unit displacement efficiency for this Type I displacement was calculated to be 69 per cent (based on laboratory data and relative permeability characteristics of this reservoir). The calculated recovery for this case is therefore 42 per cent of the oil in place.

It may be of interest to compare this value with that for a water flood. From the data in Table 1, the efficiency of this Type I displacement appears to be about equal to that for a hypothetical water flood. However, because of the low injectivity of these wells, water flooding is not economically attractive.

If the reservoir pressure were maintained at 4,000 psi. or higher, the displacement mechanism would be changed over to the Type M case. The data in Table 1 show that under these conditions a recovery of 52 per cent is obtained. It is worth noting that under the present gas-injection operation a considerable portion of this reservoir will be experiencing the more favorable Type M displacement as a result of the present high-injection pressure (above 4,000 psi.). The recovery, therefore, should be better than the 42 per cent calculated for the Type I case.

A more detailed consideration of the factors which determine these recoveries shows that the high-pressure gas (Type M) displaces nearly all of the oil (90 per cent) in the area contacted, but that the fraction of the reservoir contacted is low ($0.8 \times 73^* = 58$ per cent). Further improvement for the Type M case obviously lies in improving the fraction of the reservoir contacted by the injected gas.

As may be seen from Table 1, all of the injection plans give considerably higher recoveries than does natural depletion.

*The residual oil is so low in the swept area in the Type M displacement that the relative permeability to gas approaches unity. This leads to a higher mobility resulting in a slightly decreased pattern efficiency compared to the Type I case of 77 per cent.

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BOOK

SAUDI ARABIA. Second Edition. By K. S. Twitchell. Published by Princeton University Press, Princeton, N. J. 231 pp. $5.

First published in 1947, this book is now brought up to date through mid-1952. The new final chapter, "Developments Since 1946," with 50 new illustrations, is particularly concerned with developments in Saudi Arabia in oil and in transportation. The author is an American mining engineer who is consultant to the Saudi Arabian Mining Syndicate, Ltd.

FOUR OF THE LARGEST electrically operated wall maps in the petroleum industry are contained in the new map room of Phillips Petroleum Co. at Bartlesville, Okla.

2,361,100 sq. miles in one room!

Phillips' new map room is unique

PHILLIPS PETROLEUM CO.'s new up-to-date map room at Bartlesville, Okla., is an elaborate affair. It has four of the largest electrically operated wall maps in the petroleum industry, covering 2,361,100 sq. miles of territory.

The maps are scaled to proportion and provide a coverage of an area of about two-thirds of the entire United States.

A total of 15 employes, under direction of Floyd Wheeler, work in this unique map-room section of the company's land department. They compile information, spot locations on maps, and record other material to make sure the maps are kept up to date.

The maps, rolled up and down by means of electrically driven rollers, aid Phillips in keeping abreast of the fast-moving, day-by-day activities in the petroleum business.

Big fellow . . . One of the maps recently installed is 27 ft. wide by 270 ft. long. The top section covers the area of Alberta, Saskatchewan, and eastern British Columbia provinces of Canada, and the lower section shows the U. S. Rocky Mountain region of Montana, Wyoming, Colorado, North and South Dakota, western Nebraska, eastern Utah, eastern Arizona, and western New Mexico.

Two other maps are 135 ft. in length by 25 ft. in width, each. They cover an area extending from eastern Oklahoma to a portion of New Mexico on the west, and from the Gulf of Mexico north to and including a couple of counties in southern Nebraska.

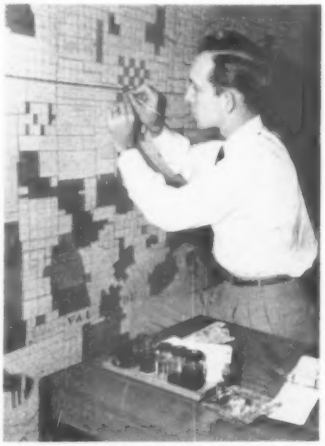
The fourth map, 102 ft. long by 15½ ft. wide, is constructed in separate sections, including the United States, a regional map of western Canada, and a Rocky Mountain regional map. The last section shows southern Illinois, southern Arkansas, all of Louisiana, and part of Mississippi.

Data posted . . . Eight men have the task of keeping the wall maps current. The maps show all of the Phillips' leases, wells, casing-head-gas contracts, and royalties, and other company concentrated blocks of acreage. Wells of all operators are also spotted on the map.

The map room serves, in addition, as the central receiving and distributing point for all scouting information.

Well checks each morning . . . During the course of a day's business Phillips' map room is a "beehive" of activity. Maps are used continuously to check on well locations and other valuable data. A check of all wells is held each morning.

During this well check, representatives from various departments within the company hear reports from division geologists on important well activity in their districts—not only Phillips' wells, but those of other operators, also.



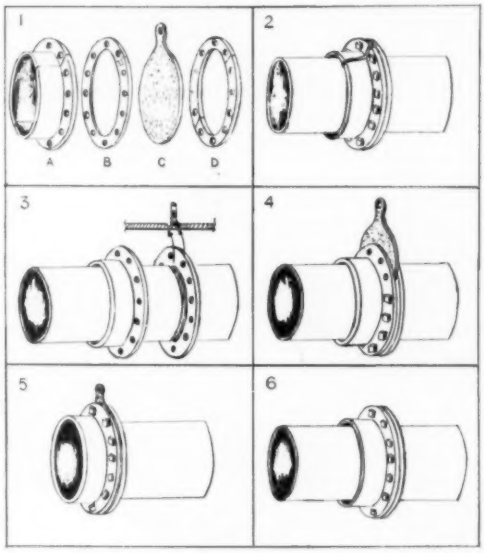
MANY LONG HOURS are required each day by map-section employes to keep the posting up-to-date. Leases, wells, and casing-head-gas contracts and royalties are all plotted on the maps, in addition to all other oil operators' wells.

Here's a safe way to make cut-outs on large-size, low-pressure gas mains

H. T. Libby*

WE recently had to divert several 16 and 20-in. low-pressure mains in order to make way for the footings to the approaches to the new Granville Street bridge in Vancouver. On the first diversion we used the conventional bag-and-stopper technique, but the main was so dirty that even after repeated attempts to clean it we were only partially successful in stopping off the gas.

The men had to use gas masks for all work in the ditch, and the other men around the job got enough gas to give them bad headaches. The danger of accidental ignition was constantly present, and everybody heaved a sigh of relief when the diversion piece was finally in and tight.



METHOD OF installing blanking-off plate in line where no flange exists. See text for reference to letters.

Plan worked out . . . The following plan was worked out and successfully used on the rest of the diversions. It was found to be easy to apply and it sealed off the gas so well that, after purging, the lines were cut and welded with acetylene and electric welder. Except for a few minutes at the start and finish, gas masks were neither required nor used. We used the idea on 16 and 20-in. mains, but there is no limitation to size on which the idea can be applied.

Step 1 . . . Make up a pair of flanges for the pipe, parts A and D, in the drawing. These flanges can be designed to weld onto the pipe or can be equipped with bell ends for caulking, or you can have one of each, if desired.

Cut these flanges radially so that they can fall into two halves. Chamfer the edges ready for rewelding.

Part B is the gasket. It is cut in one piece with a dovetail joint so that it can be put over the pipe. If the gas is coming both ways, two gaskets to each pair of flanges is desirable.

Part C is a blanking plate made of 10-gage iron sized to fit just inside the bolt circle and with a handle left on it. We refer to this part as the "frying pan."

*Superintendent, gas distribution, British Columbia Electric Co., Ltd., Vancouver, B. C. Delivered by J. R. Grey, technical assistant, before the Pacific Coast Gas Association, technical services conference, Los Angeles.

Step 2 . . . Assemble the two flanges on the pipe with the cuts at right angles to each other, so that each flange acts as a splint for the other. Make the welds necessary to restore the flanges to their original form. Line flange D up with the pipe and weld it to the pipe in the normal way. If you have planned on caulking both flanges in place, simply caulk instead of welding.

Step 3 . . . Unbolt the flanges and slide the loose one down the pipe out of the way. Use a cape chisel in a pneumatic chipping gun, groove the pipe as deeply as you dare, without actually parting the pipe. If you do break through, plug the leak with red lead putty, or whatever you like. Make the groove about ⅜ in. wide. This can be done well in advance of the cut-out.

When you are ready to cut out, part the pipe with the use of a parting chisel in the air gun. A special chisel should be used that gives a cut at least ¼ in. wide. Follow the chisel with wet rags caulked into the cut. The men doing this part require gas masks. When the pipe is entirely parted, cement the gaskets to the flanges, using Permatex or similar gasket cement.

Step 4 . . . Remove the rags, look through the cut to make sure that it is clear, grease the frying pan, and insert it. The grease makes it easier to insert and remove, and prevents the gasket sticking to it. Bring up the companion flange and bolt tight. If a diversion is being made, of course two such installations will be required, one on each end of the diversion.

Step 5 . . . Purge the pipe between the frying pans and proceed with the cut out. No gas will be present and oxyacetylene cutting may be used with safety.

Step 6 . . . Insert the new pipe into the flange. Make the joint by caulking or welding. Remove one frying pan and purge. Remove second frying pan. Tighten bolts and test. Gas mask is necessary while removing frying pans, but inasmuch as the frying pan is inside the bolt circle, only the top half bolts will need removing. Tighten up the flanges and test.

The same system can be used to advantage any time that a line is being capped off that is planned to be extended at some future date. If a pair of companion flanges and a frying pan are used to finish off the line the extension can be completed, tested and be all ready for service before any gas is introduced. It can then be put into service simply by pulling the frying pan.

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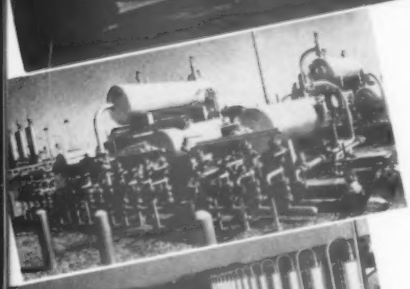

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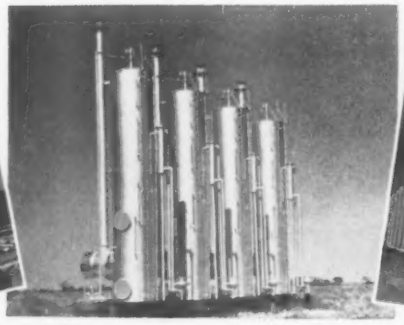

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MAINTENANCE OF
CENTRIFUGAL PUMPS—2

How to Spot Trouble Signs

by F. B. Applegate*

THE preventive section of the maintenance program should apply to both operating and idle pumps. Two very important elements in this program are well-trained operators and well-trained maintenance men. The centrifugal pump is a relatively simple machine and becomes complex only when we inject the theory of hydraulic design into operation and maintenance. Actually the basic principles governing its performance and operating characteristics can be explained clearly and are easily understood by both operating and maintenance personnel. The value of training these men is now recognized by all industries and it is included not only as a "first" but as a "must" in preventive maintenance.

Trouble signs . . . Training pays dividends because the trained man becomes a combination trouble shooter and preventive-maintenance man. He will be more careful in his routine checking and inspection of operating units, particularly of one that shows signs of distress. A drop in capacity, a drop in discharge pressure, or an increase in the power consumption of an operating pump is a sign of internal wear. Vibration, noisy operation, or a sudden increase in power demand is an indication of mechanical trouble. The trained operator will not only be quick to observe such changes from normal operation, but he will know what caused the change and what action the new conditions require.

Lubricating . . . Preventive measures for operating pumps should provide for efficient lubrication of bearings by trained oilers. The trained oiler will not overfill the bearings—overfilling causes trouble. Too much lubricant will cause leakage and overheating. This is particularly true of bearings running at high speeds where churning of the lubricant will cause bearings to run excessively hot. The temperature of the bearings should also be checked and the cooling water regulated to keep the temperature at approximately 100° F. minimum and 150° F. maximum. Operating temperatures of 120°-130° F. are usually considered ideal.

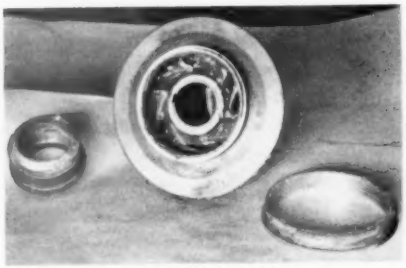
The lubrication of conventional stuffing-box packing and the cooling of the stuffing box should also be checked. Shaft seals are usually cooled by the liquid pumped.

When a pump is idle . . . The cooling water supply should be shut off and the cooling system drained. Cold water should not be circulated through the oil cooler or bearing jackets of an idle pump. The viscosity of the lubricating oil at low temperatures may be high enough to retard effective lubrication and cause damage to bearings during the start-up period. If the pump is in water service, the case should be drained. In locations where the temperature drops to 32° F. or below, the case must be drained.

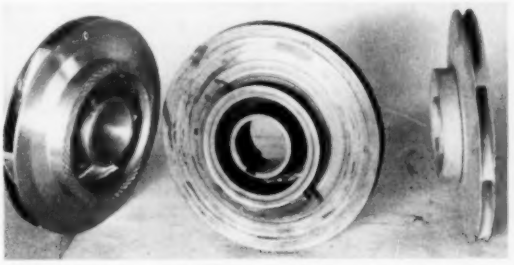
Periodic inspection should be external. Do not open a pump unless there is a drop in capacity, a drop in discharge pressure, vibration or other evidence of wear or trouble.

When reassembling a pump after an overhaul, all parts must be clean, particularly bearing housings and bearings. Use solvent, kerosine, and clean rags, not waste, for cleaning. All abutting faces must be clean and free from metallic burrs. The shaft must be straight, and the rotating element must be both straight and concentric. Ball bearings must be straight on the shaft and square against the shoulder. A bent shaft, dirt, or burrs on the face of an impeller hub or shaft sleeve or a "cocked" ball bearing will cause trouble.

* Engineer, Pacific Pumps, Inc. Paper presented at N.G.A.A. regional meeting at Midland, Tex., February 27, 1953.



DAMAGED PARTS taken from a pump that was allowed to run dry and seize. The discharge pressure gage suddenly dropped to zero but that was meaningless to the man on duty. Fig. 1.



NEW, DAMAGED AND WORN . . . (Left) New impeller ready for installation. (Center) Untrained man neglected to oil thrust bearing which burned out. Pump was badly damaged. (Right) This impeller shows 11 years' normal wear and corrosion. Pump was well maintained. Fig. 2.

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HEATING-TUBE FAILURES—5

More on Mechanical Failures

by J. J. B. Rutherford*

FIGURE 1 shows the inside and outside surfaces of a Type 347 stainless tube, 2⅜ by .120 in. which failed in service as a cooling coil in a T.C.C. kiln. This coil attains temperatures about 1,200° F. in the kiln when out of service but the sample part containing the failure, from outside the kiln, was about 200° F. out of service and 460°-475° F. when generating steam. The water being heated by abstraction of heat from the catalyst, evaporated to leave higher concentration of salts. The corrosion condition thus affected, combined with the extremely severe thermal shock, repeated about 40 times in this case, combined to cause a stress corrosion failure. (Fig. 3 shows the transgranular type of crack in this case, demonstrating that the stress factor was greater than the corrosion factor.)

Fig. 2 shows tubes of Croloy 1¼ which failed in a catalyst cooling unit, by cracking at the location where they were rolled in to fittings. The cooling-bed temperature at this point was about 1,050° F. and the water to the coils was fed or stopped to control this range. The fittings were relatively rigid by comparison with the tubes so that as the tubes changed in temperature, they acted like a bimetal element with bending forces acting about the seat as a fulcrum. Again, stress played a much larger role than corrosion in this failure. Note in Fig. 4, the crack terminus in an area of severely deformed metal.

A Croloy 7 tube, 3 by .313 in., failed after 43 days of service in an equiflux heavy-oil heater, as shown in Fig. 5. This tube had been badly overheated on the rupture side, as evidenced by the amount of scale on the outside, the metallographic structure, and the carburization on the inside. The radial cracks at the inside surface show evidence of the brittle nature of the carburized case and the cracks, when once initiated, served as stress raisers in a progressive manner.

Another case of local overheating brings out a number of interesting

* Babcock & Wilcox Co., tubular products division. From paper presented at John Zink Process Heating Seminar, Tulsa.

Fig. 1—Inside and outside surfaces of tubing at stress-corrosion failure.

Fig. 2—Croloy 1¼ catalyst cooling coil sections.

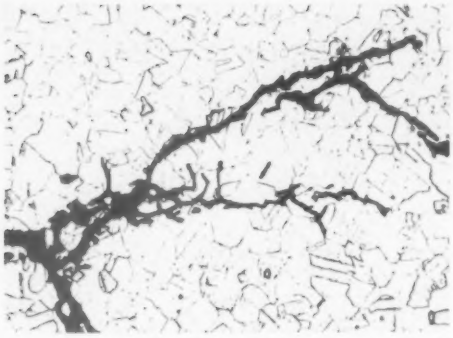


Fig. 3—Transgranular cracking, magnified—x500. (See Fig. 1.)

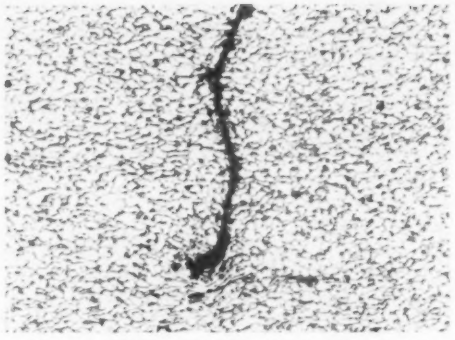


Fig. 4—Deformed metal around crack. (See Fig. 2.)

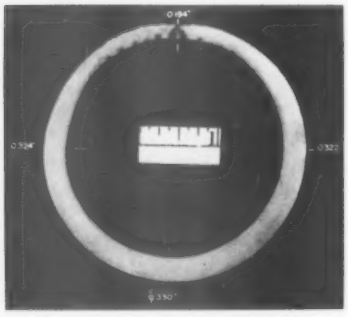


Fig. 5—Overheated tube, showing wall thinning and i.d. cracks through carburized case.

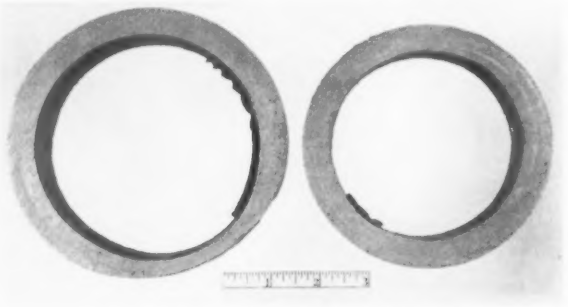


Fig. 6—Effect of uniform and nonuniform heating.

features. Croloy 5 tubes, 5 by .500 in., from a naphtha reforming furnace, are shown in Fig. 6. Of these two tubes, one is normal while the other has bulged and thinned at one side. These tubes were only in service about 240 hours but during this time, considerable change occurred in the microstructural components. From the absence of evidence of austenite, the operating temperature could not have exceeded 1,500° F., but the existence of a carburized zone in such a short period is evidence that the metal was considerably above 1,200° F. Fig. 7 shows the relation between temperature and stress causing rupture during this service life. With the stated pressure service, failure could be anticipated in these tubes in 300 hours at a temperature of 1,300° F., and in shorter periods at higher temperatures.

Failure from chemical causes will be discussed next in this series on heating-tube failures. Oxidation is the major cause of chemical attack. Factors which affect rate of oxidation will be dealt with in the next installment.

Carburization and sulfidization will be noted, as well as attack by salts.

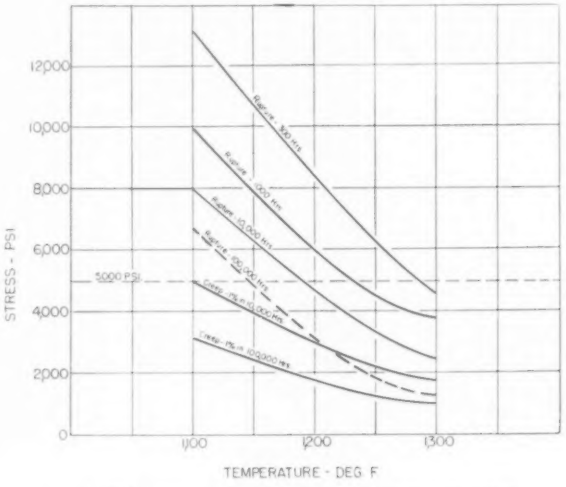
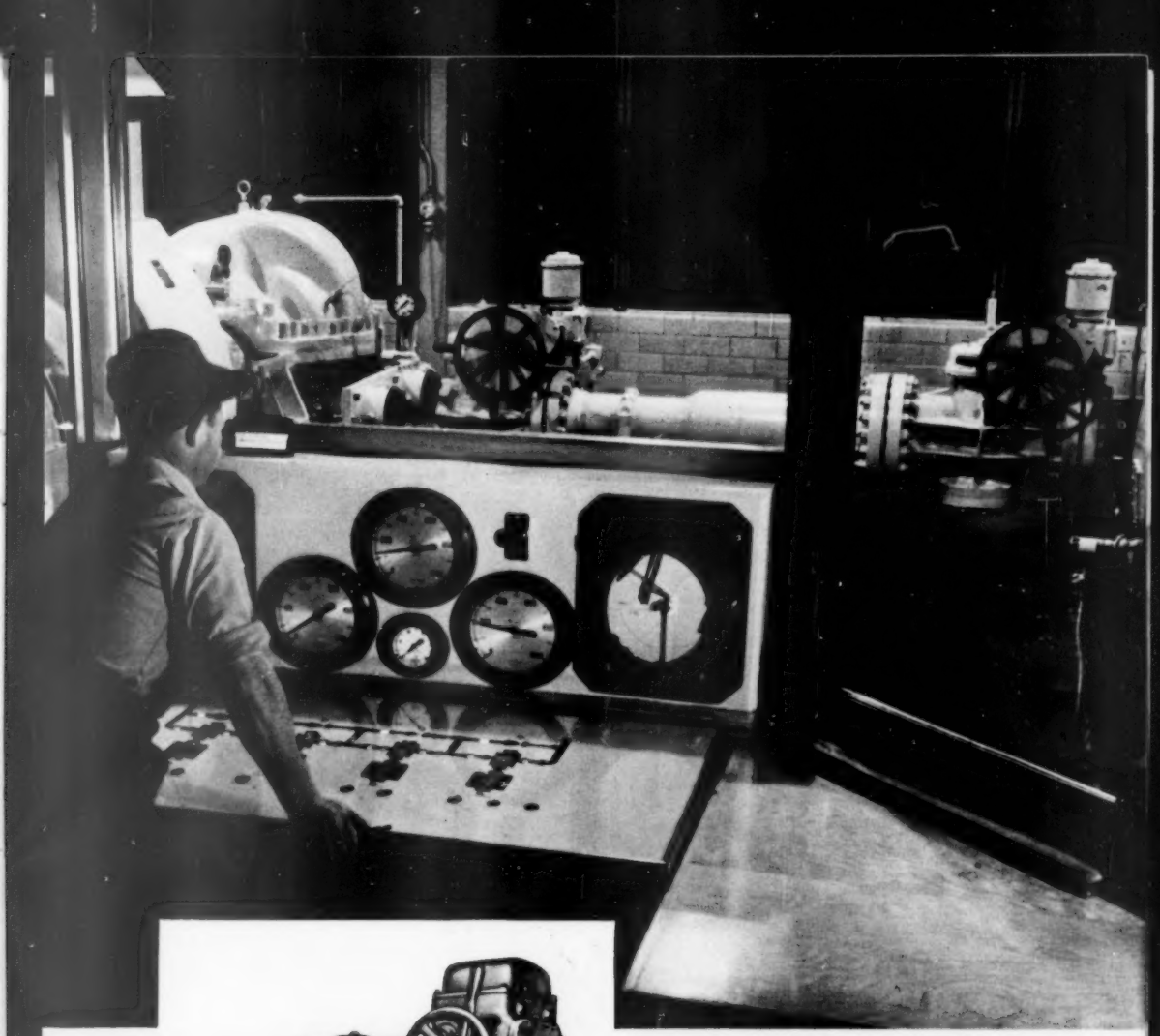


Fig. 7—High-temperature properties of 5 Cr-0.05 Mo alloy steel.



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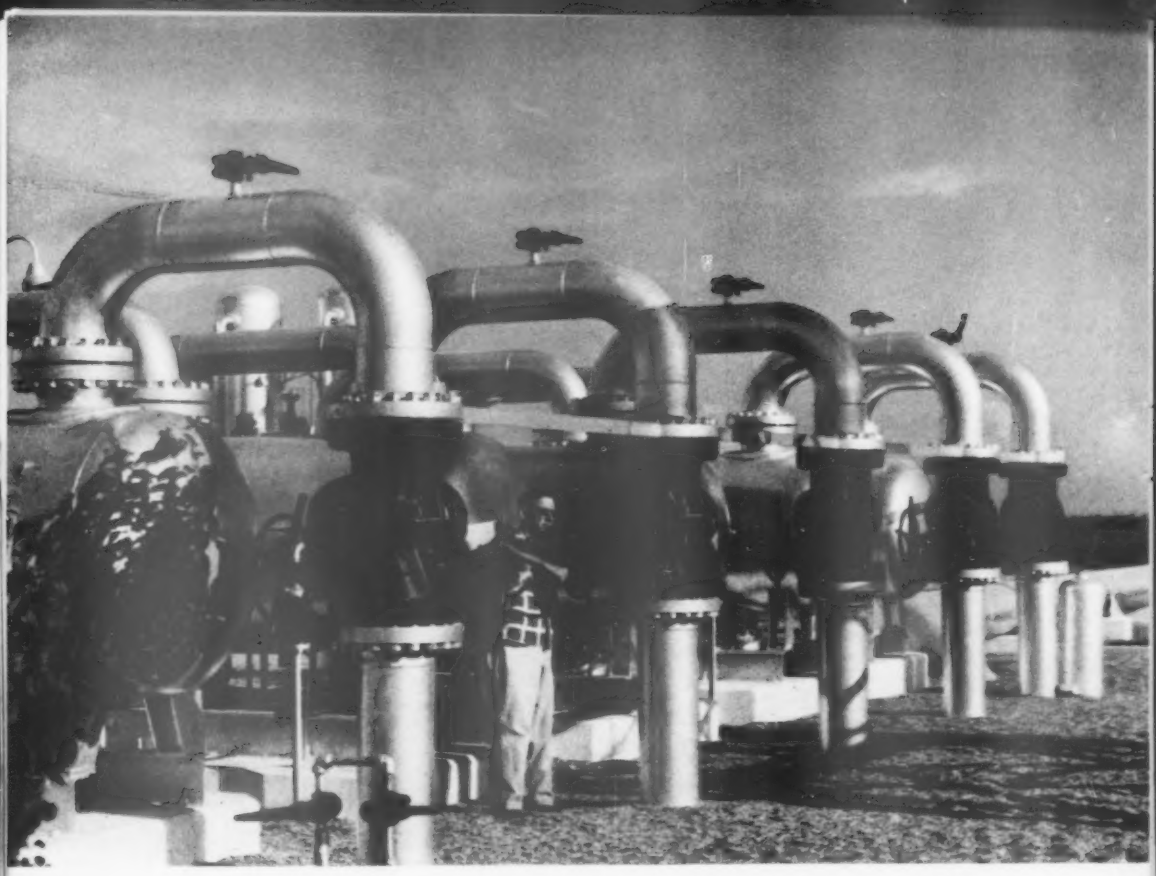

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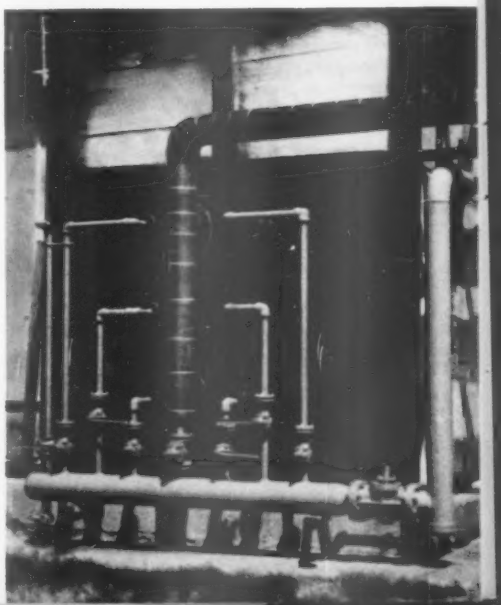

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LUBRICANT SEALED TO KEEP UPKEEP DOWN

by W. L. Nelson
Technical Editor

COST-imating

Construction Costs Continued to Rise During 1952

MATERIAL prices increased only slightly during 1952; the "materials component" index of 164.0 in 1951 rose to 164.3 for 1952. Of the materials items listed on this page, 25 increased slightly, 13 decreased, and 2 were unchanged. Meanwhile, wage rates continued to rise (from 1951 average index of 152.5 to 163.1 for 1952).

The cost indexes on this page may be used to bring the prices of the Cost-imating Series (October 21, 1948, through December 29, 1949) to current prices. Similar itemized cost indexes are published quarterly in the first weekly issues of January, April, July, and October, and the Nelson Refinery Construction Cost Index appears in the first weekly issue each month.

Itemized Cost Indexes

(Multiply the 1946 prices of the Cost-imating Series by these Index Numbers divided by 100)

	1948	1949	1950	1951	1952	Dec. 1952	References*	Index for earlier years (The Oil and Gas Journal unless noted) Cost-imating
Labor:								
Skilled construction	125.0	133.9	140.0	148.3	157.9	163.4	Eng. News Record	No. 55—Nov. 3, 1949
Common labor	131.0	140.4	148.1	156.8	168.2	175.9	Eng. News Record	No. 55—Nov. 3, 1949
Refinery construction	128.0	137.1	144.0	152.5	163.1	169.7		No. 61—Dec. 15, 1949
Refinery operation	126.0	132.9	137.6	149.1	155.1	162.6	Sur. of Current Business	No. 55—Nov. 3, 1949
Equipment or materials:*								
Boilers, tanks and sheet metal	†140.0	†134.8	†136.0	†156.1	†153.4	†150.7	Code 10-72	April 21, 1952§
Boiler tubes, 2-2¼ in.	†135.0	140.9	149.5	163.3	168.8	173.8	Code 10-14-61	
Building materials (nonmetallic)	147.1	151.2	154.8	164.3	164.4	165.8	Code‡ 13	No. 22—Mar. 17, 1949
Brick—building	122.8	127.7	132.5	141.2	140.6	140.5	Code 13-41	No. 20—Mar. 3, 1949
Brick—fireclay	133.3	139.8	153.4	165.3	167.1	173.3	Code 13-42	
Castings (foundry products)	144.6	150.5	152.9	167.2	168.0	168.4	Code 10-15	No. 46—Sept. 1, 1949
Clay products (structural, etc.)	121.3	126.0	134.6	145.2	145.8	148.2	Code 13-4	No. 20—Mar. 3, 1949
Concrete—ingredients	119.4	123.7	125.3	132.7	132.7	132.8	Code 13-2	No. 22—Mar. 17, 1949
Concrete—products	118.9	121.7	124.4	132.8	132.6	132.9	Code 13-3	
Electrical machinery	127.6	130.9	134.9	154.3	152.4	151.5	Code‡ 11-7	See Marshall-S. (below)
Electrical motors and generators	128.6	128.7	135.0	155.8	154.6	152.8	Code‡ 11-73	No. 31—May 19, 1949
Electrical transformers, etc.	127.0	129.7	131.6	147.7	148.0	149.0	Code‡ 11-74	No. 31—May 19, 1949
Engines (composite)	116.9	124.8	126.0	146.1	146.5	146.2	Code‡ 11-54	No. 36—June 23, 1949
Exchangers	130.0	133.0	140.0	152.0	165.8	169.4	Manufacturer	No. 2—Oct. 28, 1948
Fans and blowers	131.3	152.2	162.9	190.1	183.7	183.2	Code 11-47	Feb. 17, 1949§
Hand tools	125.2	134.0	143.2	154.2	155.1	158.1	Code 10-42	
Instruments (composite	120.0	123.1	127.8	142.3	146.2	148.1	Manufacturer	No. 34—June 9, 1949
Flow meter (mechanical)		109.2	114.0	126.8	132.3	135.0	Manufacturer	No. 34—June 9, 1949
Flow meter (air control)		132.4	138.5	157.6	160.5	162.0	Manufacturer	No. 34—June 9, 1949
Flow meter (remote)		130.2	135.5	151.7	155.2	157.0	Manufacturer	No. 34—June 9, 1949
Potentiometer, 6-point		125.8	134.0	146.6	151.5	154.0	Manufacturer	No. 34—June 9, 1949
Potentiometer, air control		131.6	134.1	136.8	144.9	149.0	Manufacturer	No. 34—June 9, 1949
Pressure controller recorder		130.2	135.6	153.3	158.4	161.0	Manufacturer	No. 34—June 9, 1949
Pressure gage		100.0	101.2	108.6	108.6	108.6	Manufacturer	No. 34—June 9, 1949
Thermometer (recording)		118.6	124.0	144.3	149.4	152.0	Manufacturer	No. 34—June 9, 1949
Control Valve		129.8	133.3	155.5	155.5	155.5	Manufacturer	No. 34—June 9, 1949
Insulation materials	126.8	123.6	125.0	128.8	130.4	132.6	Code 13-72	
Lumber (composite)	181.0	165.3	193.0	208.5	203.2	202.0	Code 8-1	No. 7—Dec. 2, 1948
Lumber (Southern Pine)	174.3	157.7	176.9	189.1	191.2	193.8	Code 8-12	No. 7—Dec. 2, 1948
Lumber (other soft woods)	206.5	203.9	230.2	252.7	248.5	251.8	Code 8-13	
Machinery—general purposes	124.9	131.9	136.7	153.0	151.8	150.9	Code 11-4	Feb. 17, 1949§
Machinery—construction	127.8	136.0	140.1	155.3	157.5	158.6	Code 11-2	
Machinery—oil field	†125.9	†132.9	†135.8	†149.6	†149.9	†151.3	Code 11-51	
Paint and paint materials	143.0	141.2	136.9	153.9	151.9	150.0	Code 6-2	No. 22—Mar. 17, 1949
Paints—prepared	141.4	142.8	140.0	153.8	155.7	155.8	Code 6-21	
Pipe, sewer	†119.1	†119.3	†129.9	†147.1	†146.6	†146.0	Code 13-45	No. 22—Mar. 17, 1949
Pumps, air compressors, etc.	127.0	135.9	138.2	155.9	155.6	156.0	Code‡ 11-41	No. 29—May 5, 1949
Steel (iron and steel)	141.1	143.3	152.9	166.7	168.5	171.6	Code 10-1	No. 61—Dec. 15, 1949
Steel—finished steel	160.4	173.8	182.6	196.9	201.2	206.6	Code 10-14	
Steel—plate and sheet		(See boilers, tanks, etc., above)						
Valves and fittings	†125.9	†132.9	†135.8		†226.0	†226.3	Code‡ 11-49	No. 46—Sept. 1, 1949
Marshall-Stevens equipment (only) indexes:								
Process industries (average)	131.5	131.5	135.8	144.9	145.1	145.4	Chem. Eng. Mar. 1953	Chem. Eng. Feb. 1951
Chemical	130.0	130.0	133.8	142.5	142.8	143.1	Chem. Eng. Mar. 1953	Chem. Eng. Feb. 1951
Petroleum	132.0	132.0	136.5	145.6	146.0	146.5	Chem. Eng. Mar. 1953	Chem. Eng. Feb. 1951
Electrical power	135.0	135.0	139.3	148.3	148.7	149.1	Chem. Eng. Mar. 1953	Chem. Eng. Feb. 1951
Refrigeration	141.0	139.9	147.3	159.2	159.7	160.1	Chem. Eng. Mar. 1953	Chem. Eng. Feb. 1951
Steam power	132.0	132.0	136.6	146.5	147.0	147.4	Chem. Eng. Mar. 1953	Chem. Eng. Feb. 1951
Nelson Refinery Construction	132.5	139.6	146.2	157.2	163.6	168.6		No. 61—Dec. 15, 1949

*Code refers to the revised index code number of the Bureau of Labor Statistics, U. S. Department of Labor, "Wholesale Prices." †Estimated base value for 1946. ‡Not exactly the same items as those published before July 7, 1952. §Questions on Technology.

A Good Start

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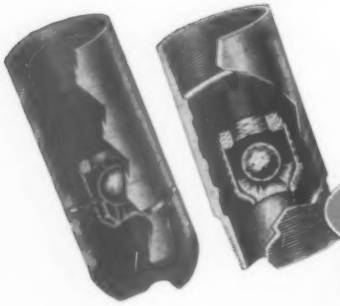

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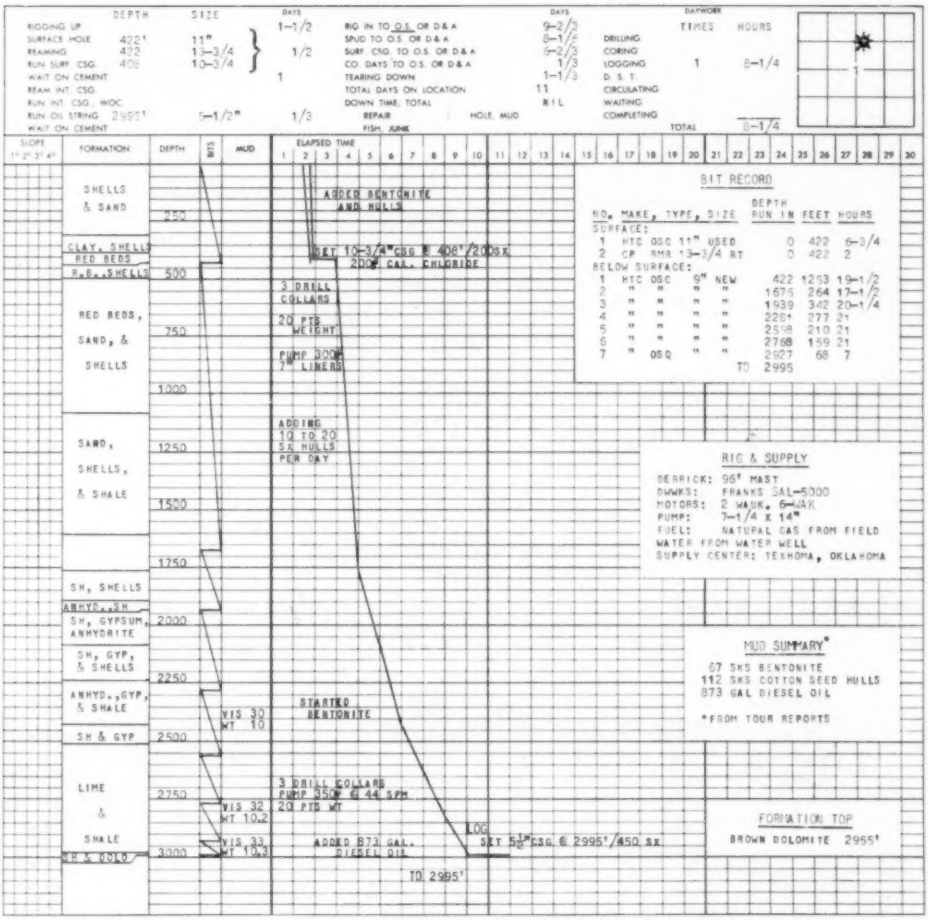
Operator: Tascosa Gas Co.

Well: 1 Hospital

Location: Section 1, Block 3, GH&H Survey, Sherman County, Texas



BIT RECORD

NO.	MAKE	TYPE	SIZE	DEPTH RUN IN	FEET	HOURS
SURFACE:						
1	HTC	OSC	11" USED	0	422	6-3/4
2	CP	RMR	13-3/4 RT	0	422	2
BELOW SURFACE:						
1	HTC	OSC	9" NEW	422	1253	19-1/2
2	"	"	" "	1675	264	17-1/2
3	"	"	" "	1939	342	20-1/4
4	"	"	" "	2281	277	21
5	"	"	" "	2558	210	21
6	"	"	" "	2768	159	21
7	"	OSC	" "	2927	68	7
				TD 2995		

RIG & SUPPLY

DERRICK: 96' MAST
DWKS: FRANKS SAL-5000
MOTORS: 2 WAUK., 6-WAK
PUMP: 7-1/4 X 14"
FUEL: NATURAL GAS FROM FIELD
WATER FROM WATER WELL
SUPPLY CENTER: TEXHOMA, OKLAHOMA

MUD SUMMARY*

67 SKS BENTONITE
112 SKS COTTON SEED HULLS
873 GAL DIESEL OIL

*FROM TOUR REPORTS

FORMATION TOP

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(Compiled for The Oil and Gas Journal by Drilling Data Service, Oklahoma City)

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by W. L. Nelson
Technical Editor

QUESTIONS ON TECHNOLOGY

Measuring High Furnace Temperatures

"In actual furnaces we never seem to encounter the high bridge-wall temperatures shown in computations in your Petroleum Refinery Engineering. We measure the gas temperature at three places as it approaches the bridge wall. Is this the same as your bridge-wall temperature?"—S.M.D.

All furnace investigators and designers are aware of the apparent discrepency between plant-measured bridge-wall temperature and the true temperatures indicated by heat balances.

The temperature of very high temperature gases must be measured by means of what are called "high-velocity" thermocouples, or better yet by "multiple shielded high-velocity" thermocouples. The gas is aspirated at high velocity past both of these thermocouples and the shielded couple is also further insulated from the furnace radiation. The temperatures shown by these three methods of measurement are indicated in Table 1.

TABLE 1
Furnace Gas Temperatures Measured by Various Methods (°F.)*

True temp.†	Plain high velocity couple	Bare thermocouple
600	600	600
800	800	785
1,000	1,000	965
1,200	1,200	1,125
1,400	1,380	1,280
1,600	1,560	1,440
1,800	1,745	1,605
2,000	1,925	1,775
2,200	2,105	1,945
2,400	2,285	2,125
2,600	2,470	2,310
2,800	2,650	2,470
3,000	2,815	2,655

*Roward, W. H., "Recent Boiler Design Practice," West Virginia section A.S.M.E. meeting, Charleston, W. Va., April 1947. Babcock & Wilcox Co., Bull. 3-407. †Nearly the shielded high velocity couple temperature.

Sour Crude Oils

"In your issue of October 27, 1952, you state that 'sour' crude oils contain more than 0.05 cu. ft. per 100 gal. How much sulfide gas is present in typical sour crude oils?" A.F.

Information is not extensive, probably because the determination (Saudi Arabia) crude oil contains of such small amounts is not an easy laboratory operation. Nevertheless, data on a few crude oils are available. The Oil and Gas Journal issue of February 11, 1937, (Crude Stabilizing Plant Planned to Avoid Shutdowns) shows that Kirkuk 289.2-336 tons of hydrogen sulfide per 80,000 bbl. Foster and Tuttle in their "Refining Mixtures of Kansas-West Texas Crude Oil . . .," The Oil and Gas Journal, January 20, 1945, page 58, state that Kansas crude contains 15 g. of sulfide per barrel and that Slaughter, West Texas, crude contains 6.8 lb. of hydrogen sulfide per 1,000 bbl. Abqaiq (Saudi Arabia) crude oil contains 120 p.p.m. according to the Oil Forum of May 1949, page 20 (Aramco's New Field has Big Sweet Curde Yield). H. A. Brown in Petroleum Processing, August 1949, page 878, shows 0.035 per cent sulfide by weight in Neibar (Dome) Wyoming crude oil. Finally, the National Petroleum News of August 7, 1946, page R-570, in an anonymous article states that East Howard, Wasson, and Howard-Glasscock, West Texas, crudes contain 4.5 tons of hydrogen sulfide per 15,000 bbl.

These scattered data are summarized in Table 1 and stated in common units. It is also of interest to note that many other high-sulfur crude oils such as those from East Texas,

TABLE 1—HYDROGEN SULFIDE CONTENT OF SOME SOUR CRUDE OILS

Crude oil	Hydrogen sulfide content: Original units	Weight %	Cu. ft. per 100 gal.
Abqaiq	120 p.p.m	0.012	0.97
Kirkuk	289.2 tons per 80,000 bbl.	0.153	over 10
Qatif Zone D*	0.27 liquid volume per cent	0.017‡	1.38‡
Kansas	15 g. per barrel	0.011‡	0.89
Slaughter, West Texas	6.8 lb. per 1,000 bbl.†	0.0023†	0.18†
Wasson, Howard-Glasscock, etc.	4.5 tons per 15,000 bbl.	0.035‡	2.85‡
Qatif unstabilized	641 p.p.m.	0.0641	5.21
Dammam unstabilized	197 p.p.m.	0.0197	1.60
Bahrein-Arabian pipe line	101 p.p.m.	0.0101	0.81
Ras Tanura refinery	243 p.p.m.	0.0243	1.98
Abqaiq	0.053 weight per cent	0.053	4.31
West Texas*	0.5-1.2 cu. ft. per 100 gal.	0.0061-0.0148	0.5-1.2

*Laboratory analysis—private communications. †Probably an error. ‡Estimated.

Pump or Machinery Foundations

"Can you tell us the approximate size of foundations to use for centrifugal pumps?" S. P. W.

Each foundation should be considered separately, but as an indication of minimum foundation sizes:

	Ratio foundation weight to machine weight
Vertical engines:	
Small	2
Large	3
Centrifugal pumps	3
Slow steam pumps	3
Horizontal gas engines	3
Steam engines	3.5
Fast steam pumps	4
Poorly balanced crank and flywheel pumps	5
Compressors	5

The weight of a yard of concrete is about 4,000 lb.

The general relationship between foundation volumes, weights, and engine horsepower is indicated in Table 1 (Kent's Mechanical Engineers Handbook, Eleventh Edition, p. 12-49, John Wiley & Sons, Inc., New York):

TABLE 1—FOUNDATION VOLUMES FOR GAS ENGINES

Type—	B.hp. per cu. yd.	Wt. engine per cu. yd. (lb.)	Wt. foundation / Wt. engine
Vertical three-cylinder	8-12	1,000-1,500	2.7-4
Vertical four-cylinder	9-14	1,000-1,500	2.7-4
Vertical six and eight-cylinder	12-16	1,400-2,000	2.0-2.9
Horizontal four-cycle, single or twin, direct connected compressor engine	4-7	800-1,300	3.0-5
Horizontal two-cycle, single	8-10	1,100-1,300	3.0-3.8
Horizontal two-cycle, twin	10-12	1,500-1,600	2.5-2.7

EQUIPMENT MEN . . . in the News

Blaydes Joins Welex As Division Sales Engineer

J. J. BLAYDES

Welex Jet Services, Inc., has announced the association of J. J. Blaydes as division sales engineer of the Gulf Coast division under J. B. Fleming, Gulf Coast division manager.

Previous to his association with Welex, Blaydes was employed by Halliburton Oil Well Cementing Co. from 1939 to 1948. He was assistant general superintendent with Spartan Tool & Service Co., in Houston, and was district sales engineer for Baker Oil Tools. In his new position Blaydes will work throughout the Gulf Coast, including Houston, San Antonio, Corpus Christi, Tex., Shreveport, and New Orleans.

Dowell Promotes Green, Gionta to Area Engineers

Dowell Incorporated has promoted Fred J. Green to area engineer with headquarters at Abilene, Tex., according to a recent announcement by Jack Sutherlin, district manager at Wichita Falls, Tex. J. A. Cummin, district manager at Wichita, Kans., has announced the transfer of Alfred Gionta to Casper, Wyo., where he will also serve as area engineer.

Green joined Dowell at Graham, Tex., in 1940, where he has been a service engineer and station manager.

Gionta came to Dowell in 1946. After 4 years with Dowell at Lafayette and Houma, La., he was sent to Maracaibo, Venezuela, where he was Western Venezuela manager for United Oilwell Service, S.A., a Dowell associate company. He held this position until his recent promotion to Casper.

Other promotions announced by Dowell include the naming of E. A. Ernst to be station manager, and John D. Halfhill as sales engineer at Abilene, Tex. Ernst began with Dowell as a district clerk at Wichita Falls. Subsequently he became a junior service engineer at Ulysses, Kans., and Graham, Tex. In 1950 he was promoted to service engineer at Graham, and he held this position until his recent transfer. Halfhill joined Dowell early in 1949 at El Reno, Okla., as a junior service engineer. Before going to his recent promotion, he was service engineer at Pauls Valley, Okla., and Abilene, Tex., and station manager at Abilene.

Dowell has established an office at Williston, N. D., which is under the supervision of J. A. McClure, and has also established offices at Glendive, Mont., and Tioga, N. D. The company also offers its oil-field and industrial chemical services at Vernal, Utah, and Sterling, Colo. Last year an office was opened at Denver where E. H. Nielsen, assistant district manager, is in charge. The men representing Dowell in the region include R. C. Abercrombie at Glendive, W. C. Gibbs at Sterling, and Harry Riggs at Vernal.

Gustin-Bacon Establishes Kansas City Sales Division

G. R. McMULLEN

Gustin-Bacon Manufacturing Co. has announced the recent appointment of George R. McMullen as manager of its Kansas City sales division. McMullen has been associated with the company since September 1952. Prior to that time he had more than 6 years' sales experience in the glass-fiber industry.

The new division will cover a four-state area, and will concentrate on sales of the company's glass-fiber insulation and industrial products.

W. M. Doughman and Grant I. Wyrick, of Kansas City, have been assigned to the division as sales and service engineers.

Bogus Named to Key Sales Post by Young Radiator

A. D. BOGUS

Anthony D. Bogus, sales engineer, has been promoted to assistant sales manager of the industrial and oil-field division, according to a recent announcement made by John J. Hilt, vice president of Young Radiator Co., Racine, Wis. In addition to his new responsibilities, Bogus will continue to handle sales and engineering of oil-field and heat-transfer equipment.

Bogus became associated with Young Radiator in 1946. He graduated from Marquette University in 1942 with a bachelor of science degree in chemical engineering.

Continental Announces Field Personnel Changes

Continental Supply Co. has announced the following changes in field personnel: M. M. Marstrand, who has been store manager at Lindsay, Okla., has taken over duties as manager at Duncan, Okla. J. B. Crews, Jr., former field salesman at Duncan, is in charge of the Lindsay, Okla., store. Both these stores are in the district headed by Van C. Moore, Ardmore, Okla.

George R. Runnels, former field au-

Enterprise Holds Annual Diesel Engine Sales Meet

Enterprise Engine & Machinery Co. held its annual diesel-engine sales meeting at Diablo, Calif. Members of the national sales organization joined home-office personnel for this 3-day session. Those participating included, seated: J. L. Adams; G. C. Rasey; J. H. Sheusner; P. I. Birchard; W. F. Butts; J. Wendell Coombs; W. E. Clayton, Jr.; G. B. Wright; R. E. Kroeck, and G. J. Brusher. Second row: M. T. Prendergast; Wren Malone; P. K. Wabnig; H. L. Hansen; J. C. Roberts; J. Neil Brophy; T. S. Pennebaker; W. E. Bishop; H. T. Anderson; Paul Sullivan; Wm. F. Haddon; Bruce Robbins, and Dale Blanton. Back row: J. E. Barthmaier; Ken Cramer; H. D. Bahr; R. L. Rahn; W. H. M. Porter; T. S. White; J. F. Yeldell; C. R. Carmichael; George Cashman, and H. R. Hogaboom.

ditor at Houston, has become store manager at Corpus Christi, Tex. N. D. Lane, whose offices are also at Corpus Christi, is district manager.

Sawhill Is Promoted to Industrial Sales Manager

C. W. SAWHILL

G. G. Bell, general manager of Aero - Coupling Corp., Burbank, Calif., subsidiary of Aeroquip Corp., has announced the appointment of Charles W. Sawhill as industrial sales manager. Prior to his new appointment, Sawhill represented the company as sales engineer throughout the West and Southwest, and in Mexico.

Before his association with Aero-Coupling, Sawhill served 8 years with Douglas Aircraft during which time he became assistant project engineer.

Beane Appointed Bristol Vice President of Sales

Harry E. Beane has been appointed vice president of sales of The Bristol Co., Waterbury, Conn., according to an announcement by William H. Faeth, president of the company.

Beane joined the Bristol sales engineering organization in 1920, and in 1925 was appointed district manager of the company's Birmingham, Ala., office. In 1930 he became district manager of the Pittsburgh district. In 1934 Beane was made sales manager of the instrument division of the company, and in 1947 promoted to the position of general sales manager.

As vice president of sales, Beane will continue to make his headquarters at the general offices of the company in Waterbury.

Correction

In its March 23 issue the Journal reported the appointment of Fred D. Getten as manager of the southwestern district of the mechanical rubber-goods division of Pioneer Rubber Mills as announced by J. E. Barton, territory representative in the southwest sales division.

In actuality Fred D. Getten, manager, southwest sales division, mechanical rubber goods, Pioneer Rubber Mills, announced the appointment of J. E. (Gene) Barton as territory representative to cover Oklahoma, the Texas Panhandle, and western Arkansas.

Honeywell Names New Regional Sales Heads

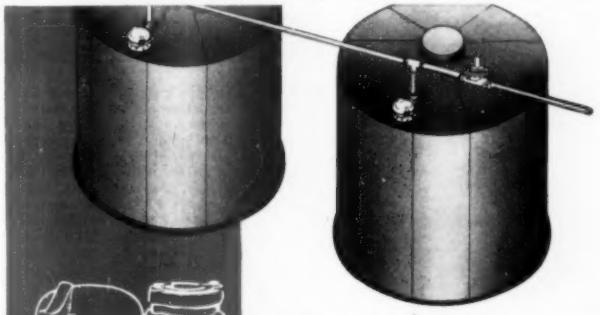
Devon W. Fryback has been named sales manager of the eastern region for the industrial division of Minneapolis-Honeywell Regulator Co., Philadelphia, it has been announced by C. L. Peterson, general sales manager.

At the same time Peterson announced the appointment of O. B. Pyle, Jr., as industrial manager of the Mid-Atlantic area, and Edward J. Klein as industrial manager for the firm's Philadelphia branch office.

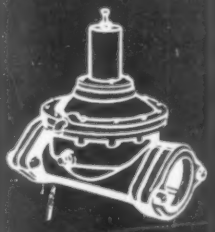
Fryback joined Honeywell in 1927 and worked in the company's Chicago, New York, and Connecticut territories. He was industrial manager in Hartford and branch manager in the Albany office. Pyle, a 24-year man with the company in the Philadelphia office, has recently been industrial manager of the branch office there.

Continental Equipment Names Canadian Agent

Appointment of The Peerless Brothers Agencies, Ltd., as Canadian representatives for Continental Equipment Co., Coraopolis, Pa., was recently an-



The Enardo Combination Gauge and Thief Hatch No. 530-B. Shipping weight, 27 lbs. All parts replaceable. Can be installed on welded, bolted or wood tanks.



The Enardo Series 1900 diaphragm In-Line Vent Valve. Made of corrosion resistant alloy and otherwise corrosion proofed. Specially suited for sour gas use.

"Truth in Advertising Builds Confidence"

Reduce gravity and volume losses NOW!

The Enardo Vapor Control System excludes excessive air from your lease storage tanks and reduces evaporation of volatile gasses. This holds losses of gravity and volumn to a minimum thereby enabling you to obtain top prices for your crude oil production.

Of foremost importance are the unique Enardo combination By-Pass Hatches. Offered in a variety of different styles, these hatches are so designed that when the hatch cover is open for gauging or thiefing the check valve automatically closes, isolating that particular tank from the rest of the battery. With the Enardo system, pressures from 1 oz. to 24 oz. may be maintained. Hatch pressures are usually 2 to 3 oz. higher than the In-Line Vent Valve.

Also used in the system is either the Enardo Series 800 or Series 1900 In-Line Vent Valve. The 1900 valve is diaphragm actuated eliminating pounding in the vapor line. Stack Valves may also be used. All these valves are corrosion resistant and have been found highly satisfactory especially in sour gas fields.

Write for complete details on the money-saving, money making Enardo Vapor Control System.

ENARDO
manufacturing company
BOX 1647 • TULSA, OKLAHOMA
"TAKING THE PULSE OF THE OIL INDUSTRY"

nounced by Arthur M. Capper, president of Continental.

Better service to customers in the provinces of Alberta and British Columbia will be gained with this appointment, Capper said. Headquarters for Peerless Brothers are in Vancouver, B. C., with District Manager C. W. McLean located at Calgary, Alta., Canada.

Pioneer Names Lachette As Territory Representative

J. E. LACHETTE

J. E. Lachette has been named as territory representative in Louisiana and Mississippi, according to a recent announcement by Fred D. Getten, territory manager, southwest sales division, mechanical rubber goods, Pioneer Rubber Mills, San Francisco.

Lachette was formerly with Superior Iron Works in its industrial division, and is therefore well acquainted with the oil-field accounts he will contact for Pioneer.

Hilliard Corp. Elects LaBrecque Vice President

T. A. LaBrecque has been elected a vice president of Hilliard Corp., Elmira, N. Y., manufacturers of HILCO lubricating, fuel, and industrial oil purification equipment. LaBrecque will continue as manager of the purifier division in charge of sales and engineering.

LaBrecque has been associated with Hilliard since 1926 specializing in the design and application of oil purifiers.

Watson Appointed WECO Sales Representative

J. D. Watson has been appointed sales representative for West Texas and New Mexico, according to an announcement made by John W. Gates, sales manager, Well Equipment Manufacturing Corp. Watson will make his headquarters in Hobbs, N. M.

Before assuming his new sales position, Watson completed an extensive program in the WECO plant at Houston, where he became thoroughly acquainted with the company's line of unions, blocks, compounds, Chiksan swivel joints, steel rotary hose, and other products.

Watson was formerly associated with Bethlehem Supply Co. in West Texas, and prior to joining WECO organization, he represented Reed Roller Bit Co. in Hobbs.

Mission Annual Sales Meeting Held in Houston

Salesmen throughout United States and Canada attended the Mission Manufacturing Co. annual sales meeting held recently in Houston, at which time W. T. Campbell, executive vice president, presented 50 service pins for periods of service ranging from 5 to 20 years. Pictured, front row, are: Dudley C. Sharp, Mission president; Ed Prather, treasurer; O. K. Ryan, Lubbock, Tex.; John Bannister, Hobbs, N. M.; Jack Bannister, Old Ocean; C. L. Turner, Shreveport, La.; D. J. Olire, Houston; and R. E. Hardy, Abilene. Second row: Campbell; G. G. Boyd, Canada; L. L. Roberson, Northern California; T. R. Fullinwider, Houston; Tony Volotko, Houston; R. L. Faris, New York City; R. L. Rathert, Farmington, N. M.; C. W. Fryar, Wichita Falls, Tex.; L. M. Roberson, Southern California; J. H. Meek, Odessa; R. L. Creasy; and Joe Scalise, New Iberia, La. Third row: J. E. Young, Oklahoma City; A. E. Higginbotham, Baton Rouge; W. C. Underwood, Houston; R. M. Wood, Mt. Carmel, Ill.; S. L. Heidemann; E. D. Hallum, Odessa; J. H. Brown, Great Bend, Kans.; M. C. Davis, Denver; F. S. Mims, Houston; E. L. Brown, Marlow, Okla.; J. S. Stewart, Houston, and F. J. Hebert, Corpus Christi.

TOTCO Takes to the Air

H. H. (Pete) Peters, vice president, Technical Oil Tool Corp., has released this view of Totco's new Cessna 170 monoplane tied up to the Richardson & Bass, Rig 9, at Point a la Hache, La. Peters stated that the new plane is based at Houma, La., and is piloted by Totco's regular service representative, Bill Lunsford. It is used to service the Houma-New Orleans coastal area.

Hammel-Dahl Names Ponton To Head West Coast Offices

Hammel - Dahl Co. of Providence, R. I., manufacturers of automatic control equipment, has announced the opening of two California offices at Los Angeles and San Francisco.

Both offices will be devoted to sales and service of Hammel-Dahl products, and will be under the supervision of Thomas H. Ponton. A graduate of University of Rhode Island, with a B.S. degree in mechanical engineering, Ponton has had previous experience in the West Coast area while associated with E. I. du Pont de Nemours & Co.

National Supply to Erect New I.P.E. Building

Workmen at Tulsa are now erecting a new building for The National Supply Co. exhibit at the International Petroleum Exposition.

National Supply has one of the largest exhibit spaces, a tract of more than 10,000 sq. ft. near the entrance to the exposition grounds. The 1948

This 140-ft. drilling mast is being raised for National Supply on the International Petroleum Exposition grounds at Tulsa.

building has been torn down, and construction is now under way for a new building to replace it.

A 200-ft. hole has been drilled and a 140-ft. mast has been erected. This is the first of a new series of heavy-duty drilling masts developed by Lee C. Moore.

National officials advise that the company will display "at least one entirely new drilling rig," "at least one entirely new engine," and "several other" entirely new products, including drilling equipment, production equipment, and tubular products.

Brand Joins M. J. Crose As Sales Engineer

M. J. Crose Manufacturing Co. Tulsa, has recently announced the appointment of John W. Brand as sales engineer. He will handle sales and service for this growing pipe-line-equipment manufacturing company.

Brand, a graduate of Oklahoma University, was in the pipe-line-construction field with Williams Brothers from 1940 through 1949. Before joining Crose he was with Midwestern Engine & Equipment Co.

New Corrosion and Abrasion Firm Organized in Texas

B. W. MOORE

Abrasion & Corrosion Engineering Co., a new firm dedicated exclusively to manufacturing, research, and testing in the field of abrasion and corrosion control, has been formed in Amarillo, Tex. The firm's three partners, B. W. Moore, E. R. McCamy, and A. G. Remke, have over 30 years' experience in the rubber-lining field.

By using many kinds of rubber, including natural rubber, neoprene, butyl, and G.R.-S. as well as numerous plastic compounds in conjunction with steel plate and other structural metals, the company can reduce corrosion and abrasion, often extending the useful life

E. R. McCAMY

A. G. REMKE

of equipment by several times. By bonding rubber to these metals, the excellent antiabrasive and corrosive qualities of rubber can be combined with the utility of the backing metal.

A product offered by Abrasion & Corrosion is a pulsating rubber sheet which is vulcanized to the edges of the covered metal only. Then by inducting air between the metal and rubber sheet, recalcitrant material such as carbon black or cement is broken loose and the natural flow of material is restored. By the use of a simple air-control valve and a timing device, pulsating rubber can effectively be used in a variety of material-handling applications.

Since there is no one application which will meet all abrasion, corrosion, and impact problems, Abrasion & Corrosion will make research one of its major undertakings. Equipment which cannot be sent to the factory can be lined in the field by Abrasion & Corrosion's field crews.

Abrasion & Corrosion Engineering Co.'s Amarillo plant.

Phillips Made Chief Design Engineer for Lane-Wells

R. A. PHILLIPS

Robert A. Phillips has been appointed chief design engineer of Lane-Wells Co., according to an announcement by Russell M. Otis, vice president in charge of engineering, research, and patents. Phillips, a graduate of California Institute of Technology, came to Lane-Wells 12 years ago and until recently has been assistant to the chief engineer.

Claude Houck, associated with Lane-Wells since 1940, has been appointed assistant to the chief engineer. He has held various positions of responsibility in the engineering department. He is a graduate of Iowa State College.

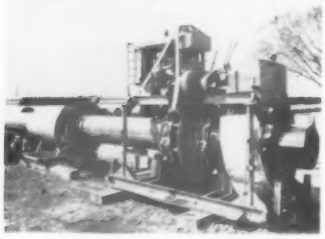
Seven New Vice Presidents Named by Norvell-Wilder

Frank S. Carothers, Houston, president and general manager of Norvell-Wilder Supply Co., has announced seven new vice presidents were elected by the board of directors after the annual meeting of the company's stockholders in the general office, Beaumont, Tex., February 17.

One of the new vice presidents is Jack M. Shaw, Beaumont, who is also sales manager for the firm. The other six are district managers in charge of the firm's branches in various cities. They are: E. V. Hubbard, district manager at Fort Worth; Alden Colston, Corpus Christi, Tex.; J. Kirby Payne, Shreveport; W. Ray Dyer, Lake Charles, La.; Tom B. Darby, Conroe, Tex., and Robert E. Durrett, Odessa, Tex. All seven men have been associated with the company for 10 years or more.

Carothers was reelected president and general manager. Other officers reelected by the board were Eugene T. Thompson, Beaumont, vice president and secretary; E. W. Gildart, Beaumont, vice president, and Frank A. Douglas, Beaumont, treasurer and assistant secretary.

FLAME DRYING
...A ROSSON-RICHARDS FIRST!



Rosson-Richards developed the propane pipe drier shown above in order to do a faster and better cleaning and priming job for you.

This machine flash dries pipe to permit running it at any time, no matter how wet it is, and guarantees that every piece of pipe run will be free of damp spots or streaks which might cause unseen damage to the priming coat.

This "extra" is typical of Rosson-Richards service up and down the line. Rosson-Richards maintains 5 permanent plants in strategic locations to serve you. Railhead facilities can be set up on or near the job for faster service.

Call Rosson-Richards for cleaning, priming, coating, wrapping or Wate-Koting, and you'll be assured of the best, most dependable, most complete service that you buy.

RR
THE ROSSON-RICHARDS COMPANIES
M&M BLDG. - HOUSTON, TEXAS

Houston • Corpus Christi • Harvey, La.
Charlotte, N. C. • Jackson, Miss.

Pipe-Line Construction

PIPE-LINE activity as reported below by The Oil and Gas Journal is compiled from information received from pipe-line companies and contracting firms.

These projects include those planned, proposed, under way, and contracted. Uncontracted projects are indicated by a • preceding the company name.

Crude-Oil Pipe Lines

• **California-Oregon Pipe Line System**—103 miles, 6-in., proposed, Crescent City, Calif., to Medford, Oregon.

• **Cities Service Pipe Line Co.**—64 miles, 18-in., under way, Sour Lake, Tex., to Lake Charles, La. Associated Pipe Line, contractors. Completion date April 1953.

Cooperative Refinery Association.—48 miles 6-in., under way, Phillipsburg, Kans., to Holdredge, Neb.

• **R. A. Goodall.**—45 miles, 6-in., planned, Little Beaver to Merino, Colo. (To connect with Sterling system).

• **Gulf Oil Co.**—22 miles, 8-in., planned, Portilla field, Texas, to Corpus Christi.

• **Gulf Refining Co.**—55 miles, 10-in., planned, Bay Marchand to Plaquemines, La.

• **Humble Pipe Line Co.**—71 miles, 16-18-in., planned, East Texas to Louisiana-Texas border. (30 miles of 16-in., and 41 miles of 18-in.) Completion date 10-53.

Under way, Hawkins field, Wood County, Texas, to Longview.

Start 7-1, Longview to Louisiana border.

• **Interstate Oil Pipe Line Co.**—137.6 miles, 22-in., planned, Shreveport to Baton Rouge, La.

Interstate Oil Pipe Line Co.—68 miles, 16-in., under way, Raceland to Anchorage, La.

Under way, Raceland to Plaquemine, La. L. E. Farley, Inc. 6-15-53.

Plaquemine to Anchorage, La.

22 miles, 18-in., contracted, Louisiana-Texas state line to near Shreveport, La. River Const. Corp. 6-53.

28 miles, 22-in., contracted, Shreveport, La., to Coushatta, La. River Const. Corp. 6-53.

Lakehead Pipe Line Co.—635 miles, 30-in., under way, Superior, Wis., to Sarnia, Ontario, Canada.

Under way, Michigan-Wisconsin State line to near Crystal Falls, Mich. Anderson Bros. 10-53.

Under way, Crystal Falls, Mich., to Cooks, Mich. Anderson Bros. 10-53.

Mackinac Pipe Line Co., Inc.—97 miles, 30-in., start 5-1, Cooks to St. Ignace, Mich. Midwestern Constructors, Inc.

• **Magnolia Pipe Line Co.**—29 miles, 8-in., planned, Midland County, Texas area.

47 miles, 4-6-8-in., planned, Nolley field, Andrews County to Magutex field, West Texas.

• **Pasotex Pipe Line Co.**—146 miles, 10-in., planned, Snyder to Wink, Tex.

• **Phillips Pipe Line Co.**—45 miles, 12-in., planned, Rancho system to Sweeny, Tex. 6-53.

• **Platte Pipe Line Co.**—93 miles, 12-14-in., planned, Chatham station near Worland, Wyo., to Oregon basin, and Byron field. R. H. Fulton Co. Completion date 6-53.

Chatham, Wyo., to Oregon basin. R. H. Fulton Co.

Oregon basin to Byron-Garland field. R. H. Fulton Co.

• **Progress Pacific Pipeline Co.**—1,100 miles, 24-in., planned, Odessa, Tex., to Los Angeles Harbor, Calif.

• **Pure Transportation Co.**—45 miles, 8-in., planned, Kimball to Gurley, Neb.

• **Roosevelt Oil & Refining Corp.**—22 miles, 4 and 6-in., planned St. Helens to Norwich, Mich.

• **Service Pipe Line Co.**—185 miles, 16-in., planned, Bowie, Tex., to Drumright, Okla.

29 miles, 4-6-8-in., proposed, Natrona County, Wyoming.

70 miles, 12-in., proposed, Tioga to Williston, N. D.

100 miles, 16-in., planned, Tioga-Beaver Lodge area to Mandan, N. D. 12-53.

41 miles, 4-6-8-in., planned, Williams and Mountrail counties, North Dakota.

• **Texas-New Mexico Pipe Line Co.**—48 miles, 8-in., planned, from Lovington, N. M.

Texas Pipe Line Co.—34 miles, 6-in., under way, Sour Lake to Port Arthur, Tex. Houston Contracting.

• **West Coast Pipeline Co.**—960 miles, 20-22-in., planned, Wink, Tex., to Norwalk, Calif.

Products Pipe Lines

H. W. Bass & Sons., Inc.—152 miles, 4-6-in., proposed, Duval and Live Oak counties, Texas, to Corpus Christi, Tex.

• **Bell Oil & Gas Co.**—150 miles, 6-8-in., planned, Ardmore to Drumright, Okla. Completion date 6-1-53.

Buckeye Pipe Line Co.—370 miles, 10-14-16-in., under way, Linden, N. J., via Allentown, Pa., to Auburn, Syracuse, Waterloo, and Rochester, N. Y.

Under way, Macungie to Guthsville, Pa. Bills Const. Co. 4-20-53.

Under way, Guthsville to Allentown, Pa. Bills Const. Co. 4-20-53.

Contracted, Guthsville to Dupont, Pa. Pipe Line Const. & Drilling Co.

Contracted, Dupont north to Pennsylvania-New York state line. Fulghum Contr. Corp.

Contracted, Pennsylvania-New York state line to Auburn, N. Y. Williams-Austin.

Contracted, Auburn to Syracuse, N. Y. Williams-Austin.

Contracted, Auburn to Caledonia, N. Y. Universal Map and Survey Co.

• **Coastal Products Pipe Line Co.**—260 miles, 20-in., proposed, Houston to Baton Rouge.

• **Continental Pipe Line Co.**—(Yellowstone Line)—600 miles, 8-in., planned, Billings, Mont., to Spokane, Wash.

• **Harbor Products Systems**—86 miles, 16-in., planned, Woodbury Junction, Philadelphia to Trembley Point, N. J. (Joint ownership of Sinclair Pipe Line Co., Gulf Oil Corp., and Texas Co.)

Indiana Farm Bureau Cooperative Association, Inc.—180 miles, 8-in., under way, Mt. Vernon to Indianapolis, Ind. R. B. Potashnick, contractor.

70 miles, 4-in., under way, Indianapolis to Peru, Ind. R. B. Potashnick, contractor.

Inland Empire Pipe Line Co.—504 miles, 10-in., proposed, Billings, Mont., to Spokane, Wash.

• **Kaneb Pipe Line Co.**—236 miles, 8-in., planned, Wichita and Potwin, Kans., to Fairmont, Neb.

• **Phillips Petroleum Co.**—54 miles, 6-in., planned, Goldsmith to Borger, Tex.

52 miles, 10-in., planned, Shell's Brookshire system to Sweeny, Tex. 5-53.

• **Plantation Pipe Line Co.**—82 miles, 14-in., planned, Charlotte to Greensboro, N. C.

Salt Lake Pipe Line Co.—140 miles, 8-in., Pasco to Spokane, Wash. Completion date 6-53.

Standard Oil Co. (Ind.).—316 miles, 12-in., under way, Sugar Creek refinery to Dubuque, Iowa.

Under way, Polo, Mo., to Unionville, Mo. Sheehan Construction Co.

Planned, Mandan, N. D., to Moorhead, Minn.

• **Standard Oil Co. (Ind.).**—243 miles, 10-12-in., proposed, Whiting, Ind., to River Rouge, Mich.

Sun Pipe Line Co.—110 miles, 8-in., under way, Fostoria to Hudson, Ohio.

Sun Pipe Line Co.—45 miles, 8-in., start 5-53, Toledo, Ohio to Inkster Junction west of Detroit. 10-53.

• **Texas Pipe Line Co.** (Evangeline Products Systems)—196 miles, 16-in., under way, Port Arthur, Tex., to Baton Rouge, La. Panama-Williams Co. Completion date 7-53.

Texas Pipe Line Co.—29 miles, under way, Fuller Ranch gasoline plant to Basin Pipe Line System, West Texas. Holder Const. Co.

• **United States Pipe Line Co.**—1,799 miles, 22-26-in., proposed, Beaumont, Tex., to Newark, N. J.

Beaumont, Tex., to Memphis, Tenn.

Memphis, Tenn., to Louisville, Ky.

Louisville, Ky., to Newark, N. J.

Laterals to Paducah and Lexington, Ky.

• **Wolverine Pipe Line System**—200 miles, 14-in., planned, Chicago to Toledo and Detroit. (Joint ownership of Shell, Texas, and Cities Service). Completion date 1-54.

Natural-Gas Pipe Lines

• **Allied Gas Co.**—24 miles, 6¾-in., proposed, McLean to Champaign County, Illinois.

• **Arkansas-Missouri Power Co.**—140 miles, 2 to 10-in., planned, St. Francis River, Clay County, Arkansas, to near Campbell, Mo.

• **Associated Natural Gas Co.**—88 miles, Missouri.

• **Atlantic Seaboard Corp.**—29 miles, 26-in., proposed, looping along Cobb-Rockville line.

• **Carolina Natural Gas Corp.**—185 miles, 2-12-in., proposed, lateral lines off Transcontinental in North and South Carolina.

• **Chattahoochee Natural Gas Co.**—70 miles, proposed, Floyd County, Georgia, to Dalton, Ga.

• **Chicago District Pipe Line Co.**—35 miles, 24-30-in., proposed, Chicago area.

Cities Service Gas Co.—21 miles, 26-in., planned, Franklin and Anderson counties, Kansas.

15 miles, 20-in., Craig County, Oklahoma, to Lawrence County, Missouri.

• **Coast Counties Gas & Electric Co.**—40 miles, 3, 4, and 8-in., planned. Coast and Valley region, California.

Colorado Interstate Gas Co.—250 miles, 20-in., under way, Kit Carson, Colo., to Amarillo, Tex. R. H. Fulton & Co., contractor.

Pueblo County to Fowler, Colo.

• **Colorado Interstate Gas Co.**—365 miles, 22-in., proposed, Green River, Wyo., to Denver, Colo.

• **Cumberland and Allegheny Gas Co.**—31 miles, 12-in., proposed, Garrett County, Md., to Keyser, W. Va.

• **East Tennessee Natural Gas Co.**—158 miles, 16-in., planned, Knoxville to Kingsport, Tenn. (58 miles of laterals.) 11-53.

• **El Paso Natural Gas Co.**—1,778 miles, proposed, Permian basin, New Mexico, Texas, and Colorado.

• **Glacier Gas Co.**—285 miles, 20-in., proposed, Kalispell, Mont., to Spokane, Wash.

120 miles, 16-in., proposed, Spokane to Hanford, Wash.

91 miles, 8⅝-in., proposed, Spokane to Lewiston, Idaho.

130 miles, 12¾-in., proposed, Spokane to International boundary at Trail, British Columbia.

• **Gulf Interstate Gas Co.**—860 miles, 30-in., proposed, Acadia Parish, La., to Boyd County, Ky.

329 miles, 12 to 24-in., proposed. Laterals off Acadia Parish, Louisiana, to Boyd County, Kentucky, line.

• **Home Gas Co.**—32 miles, 12-in., planned, Breesport to Union Center, N. Y.

17 miles, 12-in., proposed, loops from Hansock to Sanford, N. M.

46 miles, 12-in., under way, Tioga and Broome counties, New York. H. L. Gentry Const.

22 miles, 12-16-in., under way, Binghampton, N. Y.

• **Hope Natural Gas Co.**—33 miles, 8-10-12-in., planned, Wyoming County, West Virginia, south to Buchanan County, Virginia.

Houston Pipe Line Co.—40 miles, 16-in., under way, Edna to Tom O'Connor gas field. Houston Contracting Co. 4-53.

• **Interstate Power Co.**—26 miles, 8-in., proposed, from Nat. Gas P. L. Co. America line near Hooppole, Ill., to Clinton, Ia.

Iowa-Illinois Gas & Electric Co.—41 miles, 10-in., planned, Washington County to Cedar Rapids, Iowa.

• **Kansas-Nebraska Natural Gas Co., Inc.**—179 miles, planned, Kansas and Nebraska.

54 miles, 4-6-in., planned, Neligh to Hartington, Neb. Completion date 1953.

42 miles, 4-6-in., planned, Neligh to O'Neil, Neb. 9-53.

196 miles, planned, to serve Wisner, Pilger, and Stanton, Neb.

Kansas Nebraska Natural Gas Co.—70 miles, 6-8-in., under way, Nebraska City to Denver-Julesburg basin, Colo.

• **Lone Star Gas Co.**—100 miles, proposed, storage fields to the Dallas-Fort Worth area.

35 miles, 12-in., proposed, southeastern Schleicher County.

• **Manufacturers Gas Light & Heat Co.**—40 miles, proposed, Allegheny, Washington, and Beaver counties, Pennsylvania.

213 miles, 3 to 26-in., proposed, various points on system in Pennsylvania, West Virginia, and Ohio.

• **Michigan Gas Storage Co.**—30 miles, 26-in., planned, Lainsburg Junction north. 7-53.

• **Midsouth Gas Co.**—191 miles, planned, Helena to Palestine, Ark.

• **Mississippi River Fuel Corp.**—109 miles, 10-18-in., planned, laterals in Woodlawn and Waskom gas fields, Texas.

Missouri Central Gas Co.—25 miles, 6-in., contracted, Moberly to Macon, Mo. L. R. Young Const. Co.

• **Missouri Public Service Co.**—136 miles, 8-10-in., proposed, New Franklin to Trenton, Mo.

• **Montana Power Co.**—52 miles, 16-in., planned, Canada-Montana border to Cut Bank, Mont.

• **Morganfield Natural Gas Co.**—31 miles, 4-6-in., planned, through Sturgis, Providence, Clay, Diamond, Wheatcroft, and Sullivan, Ky.

• **Natural Gas Producers Inc.**—100 miles, 12-in., planned, Yenter pool to Denver, Colo.

• **Nevada Natural Gas Pipe Line Co.**—114 miles, 12¾-in., proposed, Topock, Ariz., to Las Vegas, Nev.

• **New River Gas Co.**—50 miles, planned, Summers to Monroe counties, West Virginia, to Narrows and Dublin, W. Va.

• **New York State Electric and Gas Co.**—59 miles, 8-10-24-in., proposed, Oneonta and Norwich to DeRuyter, N. Y.

New York State Natural Gas Corp.—104 miles, 14, 16, 20-in., under way, looping on Westmoreland, Armstrong, and Tioga counties, Pennsylvania. (Includes 17 miles, 16-in., in Potter County, Pennsylvania, and 21 miles 14-in., replacement in Line No. 507, New York.)

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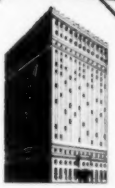

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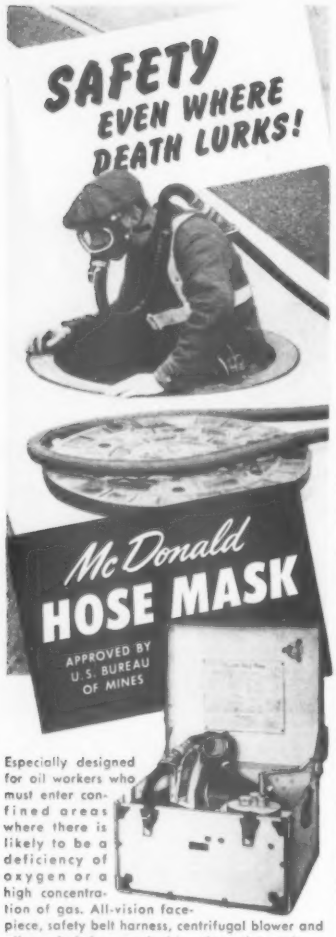

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21 miles, Columbiana and Stark counties, Ohio.

• **New York State Natural Gas Co.**—75 miles, 20-in., proposed, Cameron County to Armstrong County, Pennsylvania.

58 miles, 14 and 20-in., planned, New York State line.

Sabinsville to Boom station.

Skaneateles to Onondaga, N. Y.

Ithaca to Dryden, N. Y.

Niagara Mohawk Power Corp.—55 miles, 10-in., begin 4-1-53, Watertown to Syracuse, New York. Williams-Austin Co.

• **Northern Indiana Fuel & Light Co.**—33 miles, 8-in., proposed, Edgerton to Auburn, Ind.

• **Northern Natural Gas Co.**—580 miles, proposed, Kansas, Texas, Oklahoma, and Nebraska loops.

210 miles, 26-in., planned, five loops in Texas-Oklahoma area, two in Kansas, and two in Nebraska.

400 miles, 24-in., proposed, Emerson, Manitoba south to Red River Valley through Fergus Falls on to St. Paul, Minn.

102 miles, planned, extension.

Northern Natural Gas Co.—140 miles, 4-6-8-in., under way, south of Rolla, Kans., to Guymon, Okla. Reese Bros. Const. Co. E. H. Reese, spreadman at Hugoton, Kans.

• **Northwest Natural Gas Co.**—750 miles, planned, Washington, Oregon, and Idaho.

24-in., Eastport, Idaho, to Monroe, Wash.

18-in., Monroe to International boundary near Lynden, Wash.

22-in., Monroe to near Seattle, Wash.

20-in., Seattle to Portland, Ore.

• **Ohio Fuel Gas Co.**—31 miles, 20-in., planned, Licking County to Richland County, Ohio.

22 miles, 16-in., planned, Dayton, Troy, Piqua, and Sidney, Ohio.

23 miles, 16-20-in., planned, Wellington to Elyria, Ohio; 16 miles, 20-in., planned, Benton Station to Crawford Station; 18 miles, 20-in., Crawford Station to near Columbus; 16 miles, 16-in., planned, Berlin to Sandusky, Ohio.

74 miles, 3 to 20-in., planned, Hocking, Knox, and Ashland counties, Ohio.

47 miles, 20-in., planned, Benton Township, Hocking County, to Columbus, Ohio.

61 miles, planned, northern and southwestern Ohio.

33 miles, 20-in., proposed, Jefferson to Seneca, Ohio.

Oklahoma Natural Gas Co.—50 miles, 18-in., under way, Sapulpa to Chouteau, Okla. Engineering Const. Co. 6-53.

• **Pacific Gas & Electric Co.**—50 miles, 12-16-20-in., planned, Fresno to Merced, Calif.

(Section 1) 16-in., Burrel to near Easton, Calif.

(Section 2) 20-in., Holm to Topock-Milpitas line.

(Section 3) 12-in., parallel existing Madera-Livingston line, planned, Monterey to Fort Ord to Castroville; Napa Wye to Shellville; Cotati to Santa Rosa, Calif.

170 miles, 34-in., proposed, main-line loops along Topock, Ariz., to Milpitas, Calif.

Pacific Gas & Electric Co.—141 miles, 34-in., under way, parallel sections along Topock-Milpitas line. Engineers Pipe Line, Ltd. Summer 1953.

• **Pacific Northwest Pipeline Corp.**—1,466 miles, proposed, Ignacio, Colo., to Bellingham, Wash.

380 miles, proposed, laterals and spurs off main line to Pocatello, Idaho, to Yakima, Wash.

Panhandle Eastern Pipe Line Co.—70 miles, 24-26-in., under way, looping from Sneed, Tex., to Emporia, Kans.

174 miles, 30 and 26-in., contracted. Tus-

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cola, Ill., eastward—looping present system; R. A. Conyes, contractor.

26-in., Edgerton, Mich., Anderson Brothers.

30-in., looping in Tuscola, Ill.

30-in., looping in Montezuma, Ind.

30-in., looping in Zionsville, Ind.

• **Panhandle Eastern Pipe Line Co.**—23 miles, planned, Peoria County, Illinois.

• **Peoples Natural Gas Co.**—25 miles 6 to 24-in., planned, Cambria and Blair counties, Pennsylvania.

• **Permian Basin Pipeline Co. (Northern Natural)** — 163 miles, 16-30-in., proposed, Permian basin and eastern New Mexico.

• **Phillips Petroleum Co.**—125 miles, 2 to 24-in., planned, Midland, Upton, Glasscock, and Reagan counties, Texas. Completion date 6-53.

28 miles, 10-in., planned, Bayou Plant to Adams Terminal. Completion date 7-53.

• **Public Service Co. of Colorado**—95 miles, proposed, Douglas Creek and other gas fields to Grand Junction, Colo., area.

• **Rockland Light & Power Co.**—22 miles, 8-in., proposed, Orangetown to Tompkins Cove, N. Y.

• **Shenandoah Gas Co.**—39 miles, 3-4-8-in., proposed, Middleton, Va., to Martinsburg, W. Va.

• **South Carolina Natural Gas Co.**—160 miles, 16-12-10-in., proposed, Aiken, S. C., to cities of Columbia, Summerville, and Charleston, S. C.

• **South Georgia Natural Gas Co.**—339 miles, 2-12-in., planned, Phoenix, Ala., to Tallahassee, Fla. (a) 12-in., Phoenix, Ala., to Albany, Ga., (b) 10-in., Albany, Ga., to Moultrie, Ga., (c) 8-in., Moultrie, Ga., to Tallahassee.

• **Southern California Gas Co.**—35 miles, planned, Antelope Valley, California.

Southern California Gas Co. and Southern Counties Gas Co. of California—45 miles, 30-in., contracted, looping on line from Arizona border to Los Angeles. J. B. Gill.

81 miles, 30-in., contracted, Whitewater to Desert Center, Calif. J. B. Gill.

Contracted, looping between Blythe and Colorado River and on westward of Indio. J. B. Gill.

• **Southern California Gas Co., and Southern Counties Gas Co.**—73 miles, 30-in., planned, loops on main line from Blythe to Los Angeles.

Southern Natural Gas Co.—1,235 miles, 24 to 4½-in., contracted, Louisiana, Mississippi, Alabama, and Georgia, and South Carolina. Houston Contracting and H. C. Price. Fall 1953.

Gwinville, Miss., to Franklinton Junction, La.

Lateral from Franklinton Junction, La., to Sand Hook field, Mississippi.

Franklinton Junction, La., to Duck Lake gas field, Louisiana.

Duck Lake gas field, Louisiana, to Lake Sand field, Louisiana.

• **Southern Union Gas Co.**—21 miles, 20-in., planned, Albuquerque, N. M.

30 miles, 12-20-in., contracted, San Juan County, New Mexico. R. H. Fulton & Co.

• **Southwest Gas Corp., Ltd.**—26 miles, proposed, from P.G.&E. line to Victorville, Calif.

Tennessee Gas Transmission Co.—574 miles, 30-in., under way, Kinder, La., northeast through Louisiana, Mississippi, to Portland, Tenn., Texas, Ohio, and Pennsylvania.

Under way, Natchitoches to near Goldonna, La. Oklahoma Contr. Co. 8-53.

Under way, Bolivar to Selmer, Tenn. Oklahoma Contr. Co. 8-53.

Under way, Springfield, Tenn., to near Bowling Green, Ky. Anderson Bros. 8-53.

Under way, Campbellsville to near Danville, Ky. Western Pipe Line Constructors, Inc. 8-53.

Under way, Carter, Ky., to Ohio River. Western Pipe Line Constructors, Inc. 8-53.

Under way, Mercer, Pa., to Coudersport, Pa. H. C. Price. 8-53.

Under way, Coudersport to Hebron field, Potter County, Pa. Bechtel Corp. 8-53.

• **Tennessee Gas Transmission Corp.**—45 miles, 20-in., loops, Buffalo to U. S.-Canadian border near St. Catharines.

50 miles, 30-in., under way, Sinton and El Campo, Tex. Houston Contracting Co. 4-53.

Texas Eastern Transmission Corp. — 315 miles, 24-in., under way, Provident City, Tex., to Castor, La. Brown & Root, Inc.

Constracted, Lavaca County to Waller County, Texas. Associated Pipe Line Contractors, Inc.

Contracted, Polk County to Shelby County, Texas. Williams Brothers Co.

Contracted, River crossings of Trinity, Brazos, Colorado, and Saline rivers, Pentzien, Inc.

80 miles, under way, Warren to Livingston, Tex. Anderson Bros. 5-20-53.

• **Texas-Ohio Gas Co.**—1,435 miles, 30-in., proposed, Hidalgo County, Texas, through Arkansas, Mississippi, Tennessee, and Kentucky on to Spencer, W. Va. Completion date 6-30-53.

• **Trans-Northwest Gas, Inc.**—246 miles, proposed, International Boundary near Osoyoos, B. C., to Washington and Idaho.

275 miles, branch lines.

• **Union Oil Co. of California**—40 miles, 8-10-in., planned, San Joaquin Valley and Los Angeles Basin.

• **United Fuel Gas Co.**—50 miles, 20-24-in., proposed, Wood County to Lanham, W. Va.

• **United Gas Pipe Line Co.**—44 miles, 20-in., planned, Lirette field to Harvey, La.

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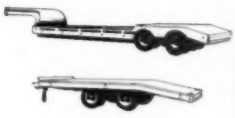

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31 miles, proposed, offshore Gulf of Mexico to Terrebonne Parish, Louisiana.

• **United Natural Gas Co.**—50 miles, 12-in., planned, Elk County to Jefferson County, Pennsylvania.

• **Utah Natural Gas Co.**—103 miles, 16-18-in., proposed, Clear Creek field near Price to Salt Lake City, Utah.

18-in., Clear Creek to Provo, Utah.

16-in., Provo to Salt Lake City, Utah.

Virginia Natural Gas Co.—153 miles, Buckingham to Richmond and Portsmouth, Va.

Warren Petroleum Corp.—78 miles, 2-24-in., proposed, Lovington, N. M. Completion date 9-53.

Westcoast Transmission Co., Ltd.—(See foreign natural gas pipe lines).

• **Western Slope Gas Co.**—79 miles, 8-in., planned, Garmesa to West Douglas Creek, Colo. Foutz & Bursum Const. Co. 10-53.

Wilcox Trend Pipe Line Co. (Harry Bass Drlg. Co.)—157 miles, 14-16-20-in., under way, gathering system for delivery to proposed Texas Eastern terminal at Provident City, Tex. H. B. Zachry. Completion date 5-53.

Under way, Lavaca County to DeWitt County, Texas, and Duval County to DeWitt County, Texas. H. B. Zachry. 5-53.

Under way, laterals and gathering lines. Altgelt Const. Co.

Foreign Crude-Oil Pipe Lines

Arabian American Oil Co.—16 miles, 12-in., under way, loops on Al Kobar, Saudi Arabia to Bahrein Island, submarine lines.

Basrah Petroleum Co.—72 miles, 24-in., under way, Zubair to Fao. Completion date May 1953.

• **Cia. de Petroleo Ganso Azul, Ltd.**—48 miles, 4-in., planned, Ganzo Azul field to Pucalpa on upper Ucayali River, Peru.

• **Creole Petroleum Corp.**—25 miles, 34-in., planned, Lagunillas to La Salina (State of Zulia). Completion date April 1953.

Direccion General de Yacimientos Petroliferos Fiscales—409 miles, under way, Plaza Huincul to Bahia Blanca, Argentina.

Interprovincial Pipe Line Co.—135 miles, 24-in., looping from Regina to U. S. border, Canada.

• **National Iranian Oil Co.**—38 miles, 12-in., planned, Lali to Masjid-i-Sulaiman, Iran.

27 miles, 12-in., planned, Kut-Abdullah to Zergan, Iran.

• **Petroleos Mexicanos.**—145 miles, 12-in., considered, 18 de Marzo field via Reynosa to Monterrey, Mexico.

100 miles, planned, Isthmus of Tehuantepec, Jose Colomo to El Plan field, Minatitlan.

72 miles, 12-in., proposed, Poza Rica to Atzacapotzalco, Mexico.

Petroleos Mexicanos.—125 miles, 10-in., under way, Jose Colomo to El Plan, Mexico.

• **Saskatoon Pipe Line, Ltd.**—56 miles, 6-in., planned, Milden to Saskatoon, Sask.

Texas Petroleum Co.—60 miles, 4-6-in., under way, Pta. Nino to La Dorada.

• **Trans Mountain Oil Pipe Line Co.**—30 miles, planned, Vancouver, B. C., terminal to Ferndale, Wash.

Trans Mountain Oil Pipeline Co.—711 miles, 24-in., under way, Edmonton, Alta., to Vancouver, B. C. Canadian Bechtel, Ltd., engineers. Completion date 8-53.

Edmonton to Acheson, Canadian Pipe Line Const. 8-53.

Acheson to Blue River, B. C., Comstock Midwestern. 8-53.

Blue River, B. C., to Coquehalla, B. C., Mannix, Ltd. 8-53.

Coquehalla to Vancouver, B. C., Comstock Midwestern. 8-53.

• **Yacimientos Petroliferos Fiscales Bolivianos.**—170 miles, 4-in., planned, Bermejo to Tupiza, Bolivia.

Foreign Products Pipe Lines

Colombian Ministry of Petroleum.—115 miles, 4-in., begin 1953, La Dorada to Cartago, Colombia, Williams Bros. Engineers.

93 miles, 8-in., begin 1953, Cantimplora to Dorada, Colombia, William Bros. Constructors.

• **Empresa Nacional del Petroleo**—80 miles, 6⅝-in., planned, Concon to Santiago, Chile.

Empresa de Ferrocarriles Ecuatorianos.—50 miles, 6-in., contracted, Guayaquil to Palmira, Ecuador. J. A. Jones, contractor; C.R.C. Engineering Co., engineers.

• **Governments of Southern Rhodesia and Portuguese East Africa.**—200 miles, considered, Beria, Portuguese Mozambique to Umtalia, Southern Rhodesia.

• **Petroleos Mexicanos.**—124 miles, 6-in., planned, Lagos to Guadalajara, Mexico.

54 miles, 6-in., planned, Lagos to Aguascalientes, Mexico.

82 miles, 8-in., planned, Salamanca to Lagos, Mexico.

• **Shell Co. of Australia.**—58 miles, 8-in., planned, Geelong, Melbourne to Newport, Australia.

• **Sun Pipe Line Co. of Canada.**—200 miles, 8-in., planned, Sarnia, Hamilton, Toronto, Ont.

• **United States Government.**—375 miles, 12-in., planned, St. Nazaire to Melun and Metz, France.

Foreign Natural-Gas Pipe Lines

• **Azienda Generale Italiana Petroli.**—110 miles, 12-14-16-in., Start 11-52. Cortemaggiore to Genoa. Completion date 11-53.

Azienda Generale Italiana Petroli—90 miles, 12-in., under way, Cortemaggiore to Bologna, Italy, SNAM crews.

120 miles, 16-in., under way, Cremona Porto Mar to Ghera, Italy, Montubi, contractor.

40 miles, 12-in., under way, Ripalta-Bergamo, Italy.

Direccion General del Gas del Estado—310 miles, 8-in., under way, Plaza Huincul to Neuquen, Argentina, to the vicinity of General Conesa, Argentina.

• **Empresa Nacional del Petroleo**—80 miles, 10¾-in., planned, Concon to Santiago, Chile.

• **Northwest Natural Gas Co.**—950 miles, 24-in., planned, Alberta fields to Vancouver, B. C., Seattle, Wash., and Portland, Ore.

Petroleos Mexicanos.—205 miles, 16-in., under way, Monterrey to Torreon, Mexico.

• **Petroleos Mexicanos.**—440 miles, 20-in., planned, Brazil to Tampico to Poza Rica, Mexico.

• **Trans-Canada Pipe Lines, Ltd. (Canadian Delhi Oil Co.)**—2,247 miles, 14 to 30-in., proposed, Alberta to Toronto to Montreal.

747 miles, 8 to 24-in., gathering system in Alberta.

• **Westcoast Transmission Co., Ltd.**—1,110 miles, 24-in., planned, Dawson Creek, B. C., through Pine Pass and Fraser River Valley to Kamloops, Princeton, and Vancouver to Portland. Ford, Bacon & Davis, engineers.

280 miles, 20-in., planned, Pincher Creek to Montana on to Spokane, Wash. Ford, Bacon & Davis, engineers.

138 miles, 20-in., planned, Sumas to Tacoma, Wash.

139 miles, 18-in., planned, Tacoma, Wash., to Portland, Ore.

• **Western Pipe Lines.**—833 miles, 24-in., proposed, from southern Alberta, eastward across the Canadian prairies, serving principal towns and cities along the route to a point near the International boundary.

This announcement is neither an offer to sell nor a solicitation of an offer to buy any of these securities. The offering is made only by the Prospectus.

NEW ISSUE

883,882 Shares

El Paso Natural Gas Company

Common Stock

(Par Value $3 Per Share)

Transferable Subscription Warrants evidencing rights to subscribe for these shares have been issued by the Company to holders of its outstanding Common Stock and $4.25 Convertible Second Preferred Stock (issue of 1949), which Warrants expire at 3:30 P.M., New York City time, on April 8, 1953, as is more fully set forth in the Prospectus. During and after the subscription period, shares of Common Stock may be offered by the underwriters as set forth in the Prospectus.

Subscription Price to Warrant Holders
$32.50 per Share

Copies of the Prospectus may be obtained in any State in which this announcement is circulated from only such of the underwriters, including the undersigned, as may legally offer these securities in compliance with the securities laws of such State.

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March 26, 1953.

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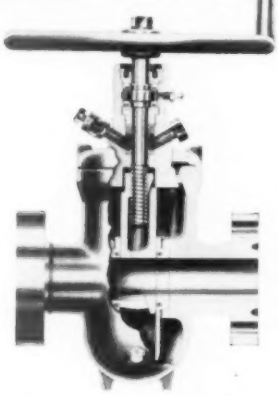

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There is no need to go into great detail to point out the advantages and economies of on-the-spot repair or overhaul. Frequently the time and money saved will amount to much more than the cost of the valve.

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OIL AND GAS EQUIPMENT Digest

IT'S NEW — CHECK IT

TRADE LITERATURE

1 DIAL THERMOMETERS, a new 24-page bulletin, describes latest development in 6-in. dial indicators for temperature, pressure, and load applications. It is generous in illustrations and supplies information on features, dials, and scale available, together with reference material on different types of actuation. *Taylor Instrument Companies.*

2 RUST-OLEUM RUST-PREVENTIVE COATINGS are featured in a pocket-size booklet, which includes 13 actual color chips for accurate color sampling, plus complete recommendations for application and use. Colors match leading equipment manufacturers' colors and are specially made to resist rain, snow, hot sun, ice, salt water, salt air, and blowing dust and sand, yet dry hard and quickly to a high gloss coating. *Rust-Oleum Corp.*

3 ORIFICE PLATES AND PLATE HOLDERS, a four-page bulletin, describes universal size orifice plates, paddle-type orifice flange plates and plate holders, and handle-type ring-joint orifice plate holders. Schematic drawings and dimensional charts are included. *Daniel Orifice Fitting Co.*

4 GENCO PLASTIC PIPE. Bulletin No. GP564-M illustrates a full line of fittings, and tubing in sizes from ½ to 4 in., both in flexible and plastic types. Applications, outstanding features, price lists, and engineering data are included. *General Plastics Corp.*

5 THREE WAYS TO WHIP CORROSION AND HIGH TUBING INSTALLATION COSTS IN YOUR PLANT. This multicolored brochure illustrates and describes three products of Dekoron tubing—instrument tubing, Impervapak Metl-Cor, and Impervapak Poly-Cor. Cutaway views and application photographs are shown. *Dekoron Tubing Div., Samuel Moore & Co.*

6 JOHNSON RIGHT-ANGLE TURBINE PUMP DRIVE is a six-page, multicolored brochure which discusses design, temperature, lubrication, and materials. In addition to schematic drawings, standard and combination-drive installation photographs are presented. *Johnson Gear & Manufacturing Co., Ltd.*

7 MODERN STEEL BOLTING FOR PIPING AND PRESSURE VESSELS is a reprint of a paper presented before the American Society of Mechanical Engineers in Kansas City, September 1952. It discusses proper selection of bolting materials, as well as comments on each A.S.T.M. specification plus tables on compilation of properties and bolting selection. *Taylor Forge & Pipe Works.*

8 IDEAL TYPE 55 CONSOLIDATED RIG. Bulletin 384 describes and pictures this medium-depth rig rated nominally at 550 input horsepower, designed for use with torque-converter-equipped engines exclusively. Rig features a large grooved spooling drum engineered for use with 1⅛-in.

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OIL AND GAS EQUIPMENT Digest NEWS CHECK IT

wire line. Bulletin contains engineering diagrams and specifications, as well as text matter and photographs. *The National Supply Co.*

9 WESTINGHOUSE MOTORS AND CONTROLS FOR THE PETROLEUM INDUSTRY. This book presents various motor and control application problems, with analyses and solutions to solve each problem. Some of the problems discussed are hazardous locations, corrosion, outdoor installations, and centralized motor control. *Westinghouse Electric Corp.*

10 LUMMUS AT DUNKIRK. This 16-page widely illustrated brochure covers Lummus Co.'s role in designing and building the modern integrated refinery of Societe Generale des Huiles de Petrole, Dunkirk, France, an Anglo-Iranian Oil Co., Ltd., affiliate. A running word-and-picture story takes the reader on a step-by-step tour through processing units. *The Lummus Co.*

11 CENTRIFUGAL PUMPS. Bulletin 7277 describes AFL line of process pumps. These units, in discharge nozzle sizes of 1, 1½, 2, and 3-in., are cradle-mounted, vertically split casing pumps, suitable for reflux pumping and transfer service handling propane, butane, gasoline, and other light distillates. *Cameron Pump Div., Ingersoll-Rand.*

12 MODEL 21-610 MASS SPECTROMETER, a four-page bulletin, describes this precision electronic instrument designed primarily to monitor and control process of chemical manufacturing and refining. Bulletin discusses operation, chemical analysis, leak detection, and sensitivity, as well as including installation photographs. *Consolidated Engineering Corp.*

13 PEERLESS TYPE TU MULTISTAGE PUMPS, a colorful 12-page bulletin, describes complete line of two, three, four, and five-stage, split-case pumps for supplying, circulating, and boosting of water and clear liquids at medium and high heads. Bulletin is fully illustrated with pump cross-sections, parts lists, dimensional data, design details, and application photographs. *Peerless Pump Div., Food Machinery & Chemical Corp.*

14 NORDBERG TWO-CYCLE DUAFUEL ENGINES is a new 3-color, 16-page bulletin which discusses design, construction, operation, and application of these Duafuel engines designed to burn gas plus pilot oil, fuel oil only, or intermediate proportions of either fuel. Bulletin is also well illustrated with typical engine installation views, and sectional views, and assembly pictures. Schematic diagram shows starting air, fuel oil and gas systems. *Nordberg Manufacturing Co.*

15 ALCOA ALUMINUM IN THE PROCESS INDUSTRIES. This brochure discusses why important process industries specify Alcoa aluminum, economic advantages, and installation views. Mechanical properties chart of Alcoa aluminum and sand casting alloys is included. *Aluminum Co. of America.*

16 TALKING OF MACHINERY, a pocket-size stock list booklet, describes and pictures sheet metal working machines, machine tools, presses, spinning lathes, circle cutting machines, wheeling, and wood-working machines. *F. J. Edwards, Ltd.*

17 WIRE LINES FOR DRILLERS. The purpose of this 64-page illustrated booklet is to give valuable tips on installation, operation, and maintenance of wire lines, and to show the right line for each specific job in drilling, why it is the right line, and how it is built to do the job. Sections are included on ropes used for rotary and cable-tool drilling, and ropes used for oil-field production work. *Jones & Laughlin Steel Corp.*

18 FARREL-BIRMINGHAM ANNUAL REPORT shows that Farrel-Birmingham billings for the year expanded 27 per cent over the previous year's figure of $25,498,754. Higher costs for wages and materials reduced pretax income substantially, but this was more than offset by dividends paid to Farrel-Birmingham by Consolidated Machine Tool Corp. after its first full year of operation as a Farrel-Birmingham subsidiary. Shipments by Consolidated in 1952 were 40 per cent above shipments for 1951. *Farrel-Birmingham Co., Inc.*

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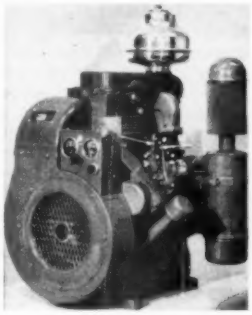
IT'S NEW CHECK IT

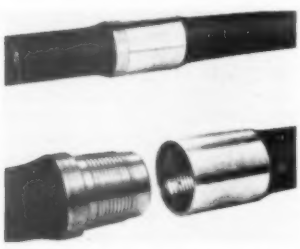
by Dan B. Miller

19 C2-90 VALVE-IN-HEAD INDUSTRIAL ENGINE is the first of a complete and competitive line of air-cooled engines ranging from 15 to 65 b.hp. The new line of engines will be lightweight, heavy-duty, air-cooled, and of high ratio of horsepower per pound. All engines will be pressure-lubricated, valve-in-head units. They will be available with any accessory or combination of accessories and carburetion required for oil-field service. Of particular importance is the bell housing and flywheel in addition to the cooling-fan flywheel which allows a greater stored energy value. The C2-90, illustrated, a two-cylinder engine, has a rated power of 30 b.hp. at 2,200 r.p.m. and maximum power and speed of 30 b.hp. at 3,000 r.p.m. Standard equipment includes engine supports, manifolds, governor, flywheel, carburetor with throttle and choke controls, oil bath, air cleaner, flame arrester, magneto with impulse coupling, spark plugs, cables, ignition switch, exhaust pipe and muffler, starting crank, stub shaft, and power takeoff. *Lycoming-Spencer Division, Avco Manufacturing Corp.*



IT'S NEW CHECK IT

20 SPANG EXTREME LINE TUBING. The tubing is upset for a male thread on one end and a female thread on the other, eliminating need for couplings. Wide, rugged, modified Acme threads provide fast joint make-up and maximum speed in running. A metal seal at the small end of the joint provides positive resistance to leakage, without depending on the threads for this protection. The ruggedness of this joint provides high resistance to damage and permits repeated making up and breaking out without galling. The fact that the joint is integral with the pipe reduces by half the number of threaded connections. Positive make-up to shoulder insures proper tightness of the joint. Joint strength is 100 per cent in all weights. The streamlined interior contour lends itself to the maximum protection afforded by plastic coating. Standard weight Extreme Line Tubing is available in 2⅜, 2⅞, and 3½-in. o.d. in both Grade J-55 and Grade N-80. It has flush inside diameter. Heavy wall Extreme Line Tubing in Grade N-80 is available in 2⅞ and 3½-in. o.d. This is provided in order that long combination strings containing either 2⅞-in. o.d. on top and 2⅜-in. o.d. on the bottom, or 3½-in. o.d. on top and 2⅞-in. o.d. on bottom will have a constant inside diameter, a desirable feature when swabbing. *The National Supply Co.*



IT'S NEW CHECK IT

21 SUPER HOLE-A-MINIT is a lightweight, portable, one-man digger that replaces hand methods used by oil-exploration crews in digging blast echo mike holes. Model 63 S, digs 6-in. holes 3 ft. deep in just 1 minute and for holes 6 ft. deep, there's Model 636 S. On this model a shaft extension is practical for digging holes beyond the 6-ft. depth. The digger operates with any air drill equipped with standard Jacobs chuck or it may be used with a half-inch or larger electric drill rated at 500 r.p.m. or less, 7 amp. or more. Its special construction and design make it practical for drilling in hard or soft earth and shale. Tool is rustproof, and engineered for long, heavy-duty performance. The Super Hole-A-Minit works in remote locations from a 1.5 kw. portable a.c. or d.c. generator. *Eugene John Freeman & Co.*

IT'S NEW CHECK IT

The Oil and Gas Equipment Digest presents a review of what is new in equipment and trade literature . . . makes it possible for readers to obtain full information on every subject by use of convenient "Check It—Mail It" service card. This periodic feature of The Oil and Gas Journal will include all that is new in equipment . . . at a time when new products are being introduced, and existing products improved.

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IT'S NEW — CHECK IT

22 BOWEN JAR SAFETY JOINT not only saves cost of one tool, but also reduces rig time required to make up the string. This device requires no torque and provides a powerful upward blow by merely exerting a straight pull on the string. A series of jarring blows can be delivered as rapidly as the string can be raised and lowered. If the stuck string cannot be jarred loose, the Jar Safety Joint can then be disconnected for recovery of everything above the joint. Later by simply using the recovered portion, the string can be reconnected with the stuck portion for subsequent recovery operation. Without coming out of the hole, the force of the blow can be easily adjusted to obtain any desired heavier blow. *S. R. Bowen Co.*

IT'S NEW — CHECK IT

23 IMPRUVOL 33, an antioxidant for motor and aviation gasoline, will provide engines with greater protection from fuel sludge and gumming at lower cost per gallon. Higher engine efficiency results from ability of Impruvol 33 to retard the formation of vapor-phase gum during the compression stroke prior to ignition, to reduce varnish and lacquer coatings on cylinder walls, pistons, and rings, and to hinder the development of acids which lead to corrosion and sludge. The new antioxidant is a 33⅓ per cent by weight solution of di-tertiary-butyl-para-cresol in toluene. Although classified as a phenolic-type antitoxidant, Impruvol 33 offers distinct advantages over both amine and other phenolic oxidation inhibitors. Impruvol 33 can be added early in the refining process without loss in subsequent operations. In addition, its antioxidant power is not so greatly reduced by contact with metals in gasoline storage and fuel injection systems as is the case with many antioxidant products. Thermal and chemical stability makes it essentially free from any tendency to form induction system deposits. *Koppers Co., Inc.*

IT'S NEW — CHECK IT

24 GASKET RING-CUTTING MACHINE is designed on the same principle as large commercial-type ring-cutting machines. This machine can also be used for cutting other materials such as cardboard, rubber, cork, and felt.

The Klingerit ring-cutting machine is robust, yet light. Its weight is only 14 lb. and thus can easily be moved. It is advisable to screw it on to a bench but it can be used equally well without being permanently attached. With this equipment, the use of which requires no special training, it is possible to cut rings up to an outside diameter of 48 in. down to a minimum inside diameter of 2 in. A steel tape is attached to the machine marked in both centimeters and inches for setting to size. It takes less than 20 seconds to cut a joint ring 24 in. in diameter and 1/16 in. thick. The machine is supplied complete with one spare cutting wheel, one ⅝-in. punch for making the center hole, and one ⅛-in. thick base disk 15 in. in diameter. *Richard Klinger, Ltd.*

IT'S NEW — CHECK IT

25 BOTTOM-HOLE CHEMICAL-INJECTION-VALVE ASSEMBLY affords an effective method of inhibiting corrosion by adding exactly controlled amounts of chemical inhibitors into tubing without losses, regardless of pressure conditions inside tubing. This is accomplished by pumping the inhibitor into the annulus (filled with inhibitor at the ratio of 40 parts carrier fluid to 1 part inhibitor) and forcing it through the chemical-injection valve set above a packer. Since this system is hydraulic, the quantity entering the tubing will be the same as the quantity pumped into the annulus at the surface. Thus, varying pressure conditions inside the tubing do not affect the amount of inhibitor injected. Use of the chemical injector valve provides protection for both sides of the tubing and the inside of the casing from top to bottom. *Macco Oil Tool Co.*

IT'S NEW — CHECK IT

26 NEW VERSION OF THE WELL GAS LOGGER. It is designed to be adaptable to any type of rig and requires a chart change only every 24 hours. The complete instrument is self-contained and housed in a steel weatherproof cabinet and can be connected to rig lighting system by a simple electrical plug from 110 volts a.c. or d.c. current. Its total weight is 340 lb.; it stands 42 in. high, 24 in. wide and 20 in. in depth. The recording logging instrument detects and measures the relative volume of minute gas shows coming up in the mud from formations being drilled. Some of its common uses are to indicate when to take a core, interpretations of electric logs as to formations containing gas, and indicate drill-stem test points and sidewall coring points. *Petroleum Instrument Co.*

IT'S NEW — CHECK IT

27 NEW CHRYSLER QUAD is a heavy-duty gas-butane power unit consisting of four banks of cylinders driving a common power-takeoff shaft. The new engine makes possible the maximum in flexibility, fuel economy, and dependability regardless of load factors. Arrangement of the engine permits operation as a single 500 maximum horsepower unit or, if desirable, where fractional loads are encountered, one or more of the four banks of eight cylinders each may be clutched out by merely disengaging a friction clutch. The new quad unit utilizes current-production, standard industrial Chrysler V-8 basic engines giving a maximum horsepower up to 500 and continuous horsepower up to 400. The multiple-cylinder, short-stroke principle of the Chrysler Industrial V-8 engine permits operation at high rotative speeds with very slow piston or frictional speeds, assuring longer piston, ring, and bearing life. The banks of cylinders may be replaced one at a time without shutting down the complete power unit. The

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fuel economy of the Chrysler Quad can be just as good at a low load factor as at full load. *Stewart & Stevenson Services.*

IT'S NEW CHECK IT

28 **SWITCH CLAMP** is a modern clamp for repairing rust-hole or pit-hole leaks in pipe lines. Heart of the repair clamp consists of a pilot pin for positioning directly over the leak; packing force-screw to force the neoprene cone into and around the leak; a thrust washer to allow rotation of the packing force-screw without turning the neoprene cone; and a sharply pointed cone of high-grade neoprene which serves to pack off the leaks. Because of the lower bolting pressure and wide draw band these clamps can be used over thin-walled pipe without danger of caving in pipe walls. Pressures to 2,000 psi. and higher can be effectively controlled in pit-hole leaks with this clamp, yet it is unusually light in weight. *Pipe Line Development Co.*

IT'S NEW CHECK IT

29 **NEW DRILL-PIPE LIFTER** features a flat surface against the smooth surface of drill-pipe pin to prevent damage and subsequent tool-joint failures. With the new pipe lifter, the work can be done without damage to the tool joint. A large, hinged semicircular shoe is fitted to a bar with a small pin and Allen set screw. The upper shoe assembly is interchangeable to accommodate various types and sizes of tool joints. *Gem Oil Tool Co., Inc.*

IT'S NEW CHECK IT

30 **NEW MODEL 21-610 MASS SPECTROMETER** makes precise, almost immediate measurement of any process-gas constituent within its range. Available accessories adapt it for use as a highly sensitive production-line leak detector or an economical analytical mass spectrometer. Either the major constituents of a process gas or trace impurities can be monitored with equal ease and accuracy. Atmospheric pressure sampling of gas streams eliminates complex pressure controlling equipment. Special maintenance features insure continuous operation, and automatic protective devices prevent instrument damage. Any individual molecular fragment from mass 12 through 40 can be monitored with satisfactory separation between adjacent masses. Where separation is not important, the range is extendable to mass 80. An auxiliary programer permits periodic scanning of a preselected group of masses, while scanning over the instrument's entire range can be readily performed at the operator's discretion. A manually operated attenuation control permits reducing sensitivity by discrete factors up to 1,000 to provide exceptionally accurate output indications over wide dynamic range. Fragment abundances are indicated by on output meter. Provision is also made for either a chart recorder or other indicating devices. The output signal may also be used to actuate servo-operated equipment. *Consolidated Engineering Corp.*

IT'S NEW CHECK IT

31 **NEW DUPLEX LINE BLIND** has been developed to incorporate a positive line shutoff with a means of accurate measurement. When used as a line blind valve, the wedge-shaped blind and full flow plate are furnished. If used as a combination orifice fitting and line blind valve, the wedge-shaped orifice plate holder with orifice plate are included. If used as an orifice fitting only, the wedge-shaped orifice plate holder and orifice plate are furnished. An O-ring is used to form a pressure seal joint between the wedge and the body seat. The elevator screw, as illustrated, in conjunction with the adjustable lug and nut enables the operator to change the flow-controlling member in a fraction of the time required when using an ordinary blind between flanges. The flow-controlling member may be changed without spreading the line. Available in flange or welding neck models. *Robinson Orifice Fitting Co.*

IT'S NEW CHECK IT

32 **14 NEW TUBE-END REDUCER,** an addition to its standard line of Ferulok flareless bite type tube fittings, is used to convert any Ferulok fitting into a combination size unit, permitting connection of a smaller size tube as is often necessary in certain tubing-system installations. The reducer is inserted into the tube connection end of the regular fitting and attached with the nut and ferrule of that fitting. The other end of the reducer is coupled to the smaller size tubing with the reducer's nut and ferrule. The new reducer is available for all commonly used reductions within the Ferulok size range of ¼ through 1-in. o.d. tubing. Ferulok fittings are offered especially for heavy-wall tubing which may be required because of high pressure or severe vibration conditions. *The Parker Appliance Co.*

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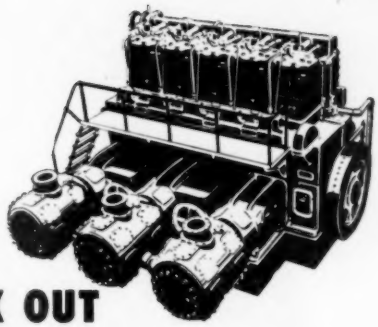

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EVERY NOW AND AGAIN it's a good idea to check your gas engine driven compressor units to see if you're getting the proper quantity of cooling water flowing freely around your power and compressor cylinders.

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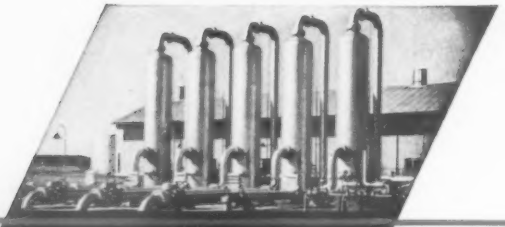

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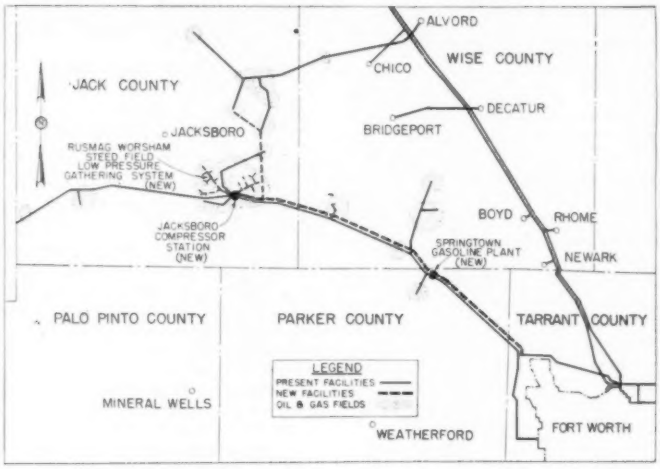

Lone Star Program

Texas facilities to step up gas-delivery capacity

Carl Hoot

DALLAS.—Lone Star Gas Co. has announced a $3,269,000 construction program which will include a field compressor station, gasoline plant, and 73 miles of gathering and transmission pipe lines. The new facilities will increase delivery capacities of gas from Wise and Jack counties, Texas, by 50,000,000 cu. ft. daily.

The new program includes facilities for gathering and marketing casing-head gas, which previously has been flared in Worsham-Steed and Rusmag fields of southeast Jack County.

The new gasoline plant, now under construction, is being built near Springtown in Parker County, and is scheduled to begin operations in July.

Transmission lines . . . Construction of transmission lines will start in June, with the laying of 24.63 miles of 20-in. pipe; 17.5 miles of 16-in., and 3.3 miles of 10-in. Thirty-five miles of 20 and 16-in. pipe will loop present transmission lines in Jack, Wise, Parker, and Tarrant counties. This loop will originate near Jacksboro and extend southeast to a point northwest of Fort Worth, where it will connect with Lone Star's integrated pipe-line system.

A 10-mile section of 10 and 16-in. pipe will connect Lone Star's two transmission lines in Jack and Wise counties, boosting capacity of lines serving wells in northeast Jack County.

Completion of the transmission lines will give the company capacity to transport gas at the rate of 120,000,000 cu. ft. daily into the Fort Worth-Dallas region from Jack and Wise counties.

Other facilities . . . Facilities for marketing casing-head gas in Worsham-Steed and Rusmag fields include a 27.72-mile gathering system of various sizes, and a 3,320-hp. compressor station near Jacksboro to boost the low-pressure gas before entering Lone Star's transmission lines. This portion of the program is scheduled to get under way in April.

Lone Star presently is taking gas from 79 wells in Jack and Wise county fields. Completion of the new transmission and gathering lines will enable the company to take from more than 200 wells in the two counties.

Lone Star crews will be used in the construction, with Decatur and Jacksboro designated as construction headquarters. The over-all program is scheduled for completion by early fall.

United Fuel's Facilities For Gas Storage O.K.'d

WASHINGTON.—United Fuel Gas Co., Charleston, W. Va., has obtained Federal Power Commission approval to construct pipe-line facilities to activate and operate a new storage pool near Ripley in Jackson County, West Virginia.

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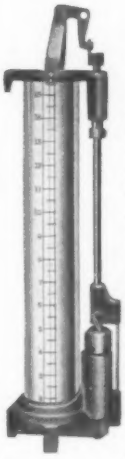

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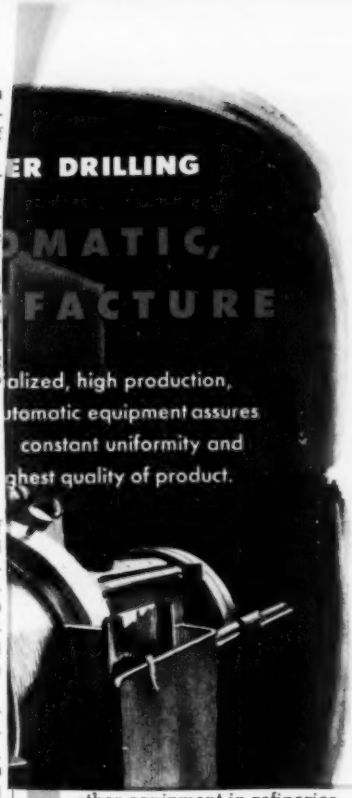

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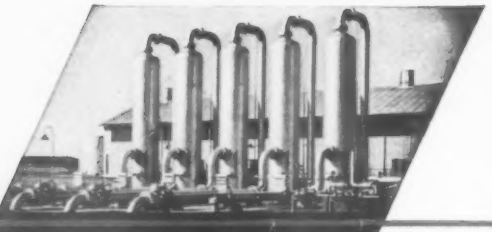

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This is the Fluor Model DV Gas Cleaner, an oil-injection type scrubber for removing dust from dirt-laden gas. It is known for its superb cleaning efficiency, non-slugging characteristics, rugged qualities, and its fine balance between the oil-injection rate and the extraction ability of the elements and "drop out" areas.

The dust particles in gas passing through a Venturi-type oil spray chamber are thoroughly wetted, regardless of the quantity, pressure and temperature of the gas in the line. There are no moving parts or special mechanisms – the rate of flow of gas through the cleaner automatically determines the quantity of oil that is aspirated with the gas. Because of the variations in suction pressure common to gas transmission service, the gas cleaner is designed to operate through a broad pressure range at full capacity.

Three expansion areas and two mist-extracting elements remove the remaining liquid so effectively that Fluor guarantees a carry-over not to exceed .05 gallon per million standard cubic feet of gas. Reliable tests on a well-known gas line found carry-over of Fluor DV Gas Cleaners less than .01 gal./mmscf.

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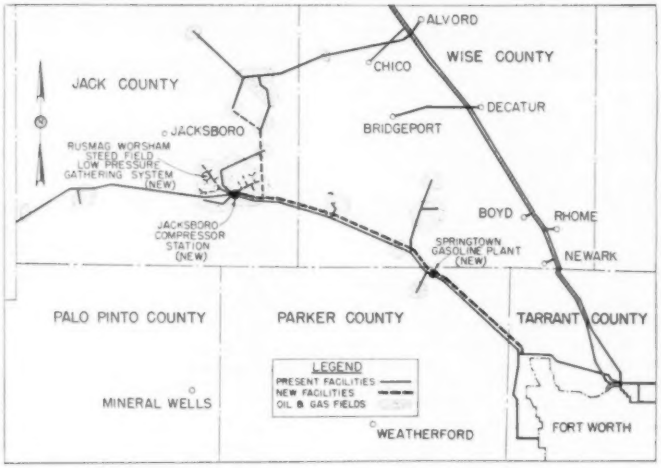

Lone Star Program

Texas facilities to step up gas-delivery capacity

Carl Hoot

DALLAS.—Lone Star Gas Co. has announced a $3,269,000 construction program which will include a field compressor station, gasoline plant, and 73 miles of gathering and transmission pipe lines. The new facilities will increase delivery capacities of gas from Wise and Jack counties, Texas, by 50,000,000 cu. ft. daily.

The new program includes facilities for gathering and marketing casing-head gas, which previously has been flared in Worsham-Steed and Rusmag fields of southeast Jack County.

The new gasoline plant, now under construction, is being built near Springtown in Parker County, and is scheduled to begin operations in July.

Transmission lines . . . Construction of transmission lines will start in June, with the laying of 24.63 miles of 20-in. pipe; 17.5 miles of 16-in., and 3.3 miles of 10-in. Thirty-five miles of 20 and 16-in. pipe will loop present transmission lines in Jack, Wise, Parker, and Tarrant counties. This loop will originate near Jacksboro and extend southeast to a point northwest of Fort Worth, where it will connect with Lone Star's integrated pipe-line system.

A 10-mile section of 10 and 16-in. pipe will connect Lone Star's two transmission lines in Jack and Wise counties, boosting capacity of lines serving wells in northeast Jack County.

Completion of the transmission lines will give the company capacity to transport gas at the rate of 120,000,000 cu. ft. daily into the Fort Worth-Dallas region from Jack and Wise counties.

Other facilities . . . Facilities for marketing casing-head gas in Worsham-Steed and Rusmag fields include a 27.72-mile gathering system of various sizes, and a 3,320-hp. compressor station near Jacksboro to boost the low-pressure gas before entering Lone Star's transmission lines. This portion of the program is scheduled to get under way in April.

Lone Star presently is taking gas from 79 wells in Jack and Wise county fields. Completion of the new transmission and gathering lines will enable the company to take from more than 200 wells in the two counties.

Lone Star crews will be used in the construction, with Decatur and Jacksboro designated as construction headquarters. The over-all program is scheduled for completion by early fall.

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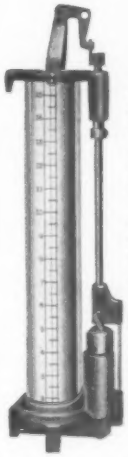

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Among the Drilling Contractors

Kansas Rig Puts Down 101 Wells in 608 Days

Rex & Morris Drilling Co., Eldorado, Kans., drilling contractor and operator, reports that with one rotary rig it drilled 101 wells, averaging 2,671 ft. in depth, in a period of 608 days. The time included rigging up, drilling, shutdowns for all causes, tearing down and moving. Aggregate footage was 269,782 ft. Average time was a little more than 6 days per well.

All wells were in a hard-formation area of eastern Kansas requiring the use of rock bits from the grass roots down. Limestone rock at the surface added to the drilling difficulty since the short string used in surface drilling precluded the use of sufficient drill collars to provide needed weight on the bit for fast drilling.

The rig was an Ideal Type T-25, powered by a General Motors Series 6-71 Twin-6 engine with torque-converter drive. It employed an independently driven mud pump unit, consisting of an Ideal Type C-150-B pump with the same type engine as that on the draw works. It had a Type FE-17½-44 rotary. Drilling was with Spang 4½-in. o.d. drill pipe with 5¾-in. o.d. double-seal, shrink-thread tool joints and 5¾-in. o.d. replaceable-end drill collars. The original string was used for all wells.

Drilling was under the direction of B. C. Keevert, drilling superintendent, and Otto Berens, head driller. W. H. Rex and J. E. Morris are coowners of the company.

Ray Holbert has a new operation under way in the Willow Springs field, in Gregg County, East Texas, where he is drilling for S. J. Felsenthal. The new test is 1 Culpepper, in the William Robinson Survey.

Wise Drilling Co., San Antonio, is starting a wildcat test 4 miles southeast of Quitman, Wood County, East Texas, with William Tobian as the operator. Location is for 1 Carmichael, in the George W. Watson Survey.

Viersen & Cochran, Okmulgee, Okla., will drill a 13,000-ft. wildcat test for Mercury Drilling Co. west of the Chitwood field, in Grady County, Oklahoma. Location is for 1 Whitener unit, in the C NW NE 25-5n-7w.

O. W. Dyer, Houston, has contracted with Shell Oil Co. for a 9,000-ft. wildcat test to be drilled in Chandeleur Sound, offshore from St. Bernard Parish, Louisiana. Location is in Block 40, a state tract.

Crow Drilling Co., Inc., Shreveport, is starting a Bodcaw (Cotton Valley) wildcat test 3½ miles northeast of

On the floor of Rex & Morris Drilling Co. rotary rig which drilled 101 wells, averaging 2,671 ft. in depth, in 608 days. Making up additional stand of drill pipe are, left to right: Mike Walker, Otto Berens (head driller), V. C. Reed, and Jim Harvey.

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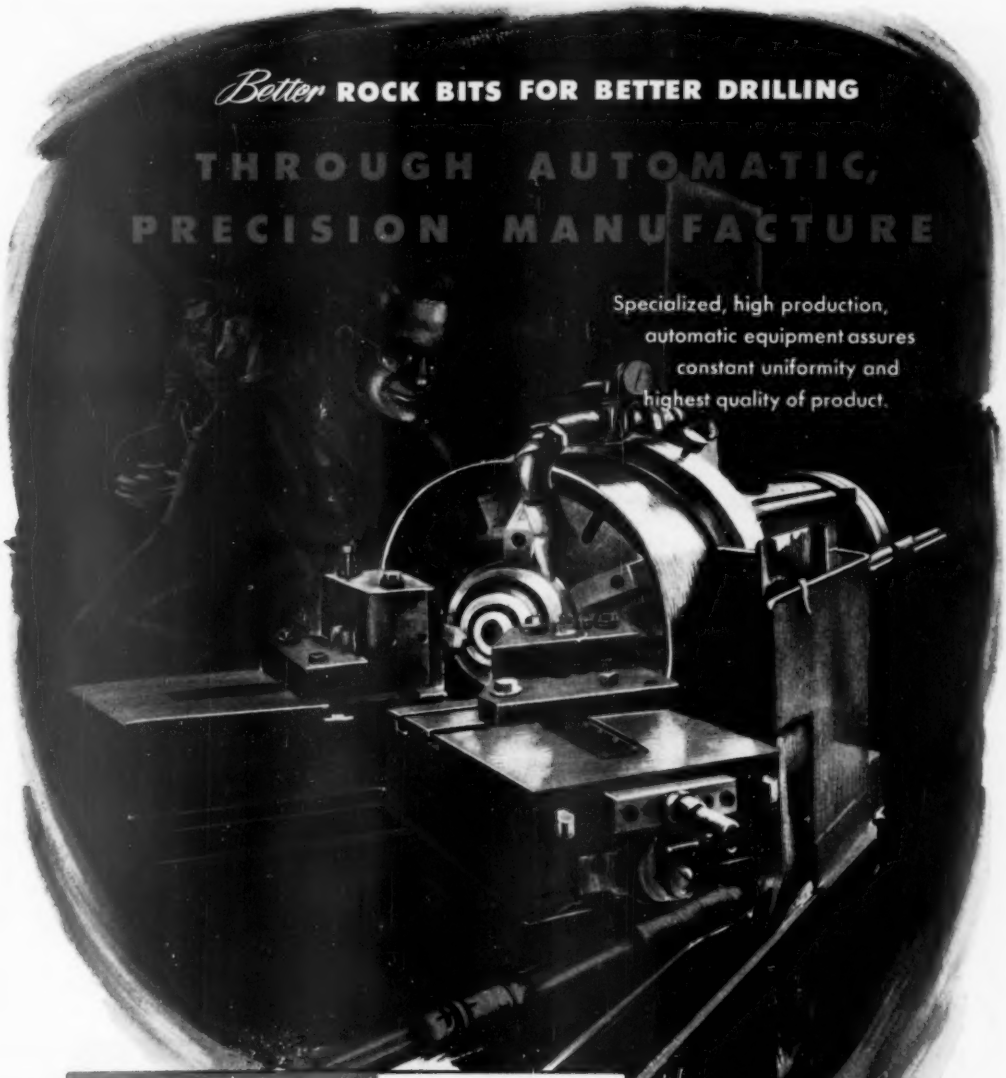

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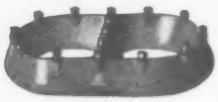

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Antioch, Claiborne Parish, northern Louisiana. Contract is for Lyons, McCord & Logan. The test is listed as 1 Meadors with location in the C W½ SW 8-22n-5w.

J. C. Means Drilling Co., Beaumont, Tex., has the contract and has moved in rig to drill another test, the fourth, for Sun Oil Co. in the recently opened North Starks field, on the Calcasieu-Beauregard parish line, in southern Louisiana. Latest operation is 2 Nichols.

R. H. Gracey Drilling Co., Houston, has contracted with Union Oil Co. of California for a 13,000-ft. wildcat test to be drilled 1½ miles east of the West White Lake field, in Vermilion Parish, coastal Louisiana. Location is on the operator's State Lease 2119.

Muckelroy Drilling Co., Houston, has contracted for a 10,000-ft. test to be drilled for Russell McGuire at a wildcat location 9 miles northwest of Crosby, in northeastern Harris County, Texas Gulf Coast. Name is 1 Harris.

Montgomery Drilling Co., El Dorado, Ark., drilling for Don D. Montgomery and associates, is starting a west offset to the recently completed discovery well of Cotton Valley production east of the Lisbon field, in Union County, Arkansas. The new operation is 1 Milner heirs, located in the C SE NW 14-17s-16w. Hole is projected to 5,000 ft.

Delta Drilling Co., Tyler, Tex., has contracts for two more 10,000-ft. wells to be drilled for Lone Star Producing Co. in the Opelika field, 5 miles northeast of Murchison, in Henderson County, East Texas. The new operations are 1 Edwards, in the J. Graff Survey, and 3 Mayfield, in the John E. Clancey Survey.

ACTIVE ROTARY RIGS*

(United States and Western Canada)

Area—	Week ended 3-30-53	Change week ended 3-23-53	Change week ended 3-31-52
Gulf Coast	585	—14	— 27
N. & W. Tex.-N. M.	832	— 5	—232
Ark.-N. La.-E. Tex.	121	+ 2	— 23
Oklahoma	321	—15	— 8
Kansas-S. Nebraska	180	0	+ 19
Illinois-Eastern	89	— 9	+ 6
Rocky Mountains	188	+ 6	+ 27
Pacific Coast	164	+ 5	+ 8
Total U. S.	2,480	—30	230
Western Canada	159	—13	10
Total	2,639	—43	240

*Courtesy Hughes Tool Co. Trends in drilling activity in the United States and the North and West Texas-New Mexico and Oklahoma-Kansas areas are shown on pages 183 and 184.

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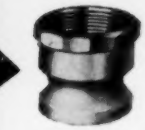

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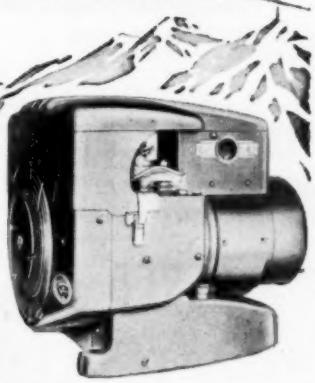

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REFINING

Bids Being Accepted for New Pan-Am Reforming Unit

TEXAS CITY, Tex.—Bids are now being accepted for construction of a catalytic reforming unit at Pan American Refining Corp.'s refinery here, according to Dr. Harold R. Snow, vice president and general manager.

At the present time it is impossible to determine exact costs since no contract has been let, however, the company received a fast tax write-off certificate from the Defense Production Administration to the extent of $7,265,000.

Various types of reforming processes are being considered and once bids have been studied, the capacity, type and cost of the unit will be made known.

Plans call for the unit to be in operation sometime in 1955, with approximately 18 months required for actual construction.

Magnolia Contracts T.C.R. Unit to Lummus Co.

BEAUMONT, Tex.—Magnolia Petroleum Co. has awarded a contract for a multimillion-dollar thermofor catalytic reforming unit here to Lummus Co., New York. Initial operation of the unit is expected during the first half of 1954. Construction will begin following completion of final engineering, which will require about 3 months.

Cost of the project was not announced. However, Socony-Vacuum Oil Co., with which Magnolia is affiliated, originally announced a total cost of $27,000,000 for three such units and a catalyst manufacturing plant at Paulsboro, N. J. The other units will be located at Torrance, Calif., and Augusta, Kans.

The unit here will be 250 ft. high and will charge 19,000 bbl. of naphtha daily. Ten storage tanks, a cooling tower, and necessary piping also will be constructed.

A pressurizing sphere for the catalyst entering the reactor will be a major feature of the design. Automatically timed valves will open and close to permit holding of pressures during the entrance of the catalyst into the reaction chamber.

Grace Chemical Contracts For New Nitrogen Plant

NEW YORK.—Grace Chemical Co. has announced here that Foster Wheeler Corp. will handle engineering and construction of its $19,000,000 nitrogen plant to be built near Memphis. Construction is scheduled to begin in May.

The plant will employ an air separation unit designed by Air Products, Inc., the Texaco partial oxidation process to manufacture syntheses gas, the Casale process to manufacture ammonia, and the Pechiney process for the manufacture of urea using byproduct carbon dioxide from the Casale unit.

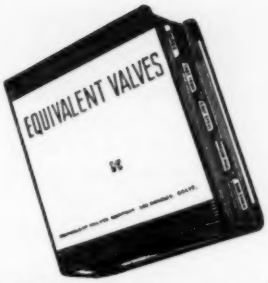
NELSON REFINERY CONSTRUCTION INDEX

Appears in the first issue each month.
Explanation—"News Items that Appear in Quarterly Cost Indexes," July 7, 1952, pages 105 and 106.
Compiled by W. L. Nelson—Petroleum Refinery Consultant—Tulsa.
Indexes of Individual Equipment Items—January, April, July and October.

INDEX (1946 = 100)

	1948	1949	1950	1951	1952	Dec. 1952
Pumps, compressors, etc.	127.0	135.9	138.2	155.9	155.6	156.0
Electrical machinery	127.6	130.9	134.9	154.3	152.4	151.5
Internal combustion engines	116.9	124.8	126.0	146.1	146.5	146.2
Instruments	120.0	122.0	127.8	142.3	146.2	148.1
Heat exchangers	130.0	133.0	140.0	152.0	165.8	169.4
Miscellaneous equipment average	*122.1	*121.6	*126.2	*145.1	153.3	154.2
Materials component	139.3	143.6	149.5	164.0	164.3	167.0
Labor component	128.0	137.1	144.0	152.5	163.1	169.7
Refinery construction index	132.5	139.7	146.2	157.2	163.6	168.6

*Used in computing the Nelson Index until April 1952. These are slightly different than the average of the Miscellaneous Equipment Items shown above.



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Polyethylene Plant Planned By Spencer at Orange, Tex.

ORANGE, Tex.—Plans to build a plant near here to produce approximately 45,000,000 lb. annually of polyethylene have been announced by Spencer Chemical Co., Kansas City.

Kenneth A. Spencer, president, said arrangements had been made for a long-term supply of ethylene, the principal raw material needed. The plant, to be in operation by the spring of 1955, will employ about 250 persons.

The company also announced it had completed a contract with Imperial Chemical Industries, Ltd., London, holder of the basic patents on the polyethylene process. Imperial has licensed Spencer to operate under its patents, and will train Spencer personnel and assist in engineering design.

Spencer said a special meeting for stockholders had been called for April 10 to consider increasing the authorized indebtedness of his company to carry out the project.

Spencer Chemical has entered into a long-term purchase agreement with Gulf Oil Corp., which will deliver ethylene to the new plant by pipe line from its refinery at Port Arthur, Tex.

Scrubber Converted

A caustic scrubber has been converted for treating benzene at Cosden Petroleum Corp.'s plant at Big Spring, Tex. While the unit was not originally intended for treating benzene, it was subsequently put to that use when it became apparent that benzene must be dry to meet nitration grade specification. Left column in the picture is the caustic scrubber, and the distillation or drying column is on the right. The two columns were fabricated from 16-in. pipe, are 28 ft. high, and are packed with 1¼-in. Raschig rings. The unit was designed and built by the plant's engineering department.

See Composite and Refinery Catalogs, or Write for Folder Oa

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EVERY TIME...

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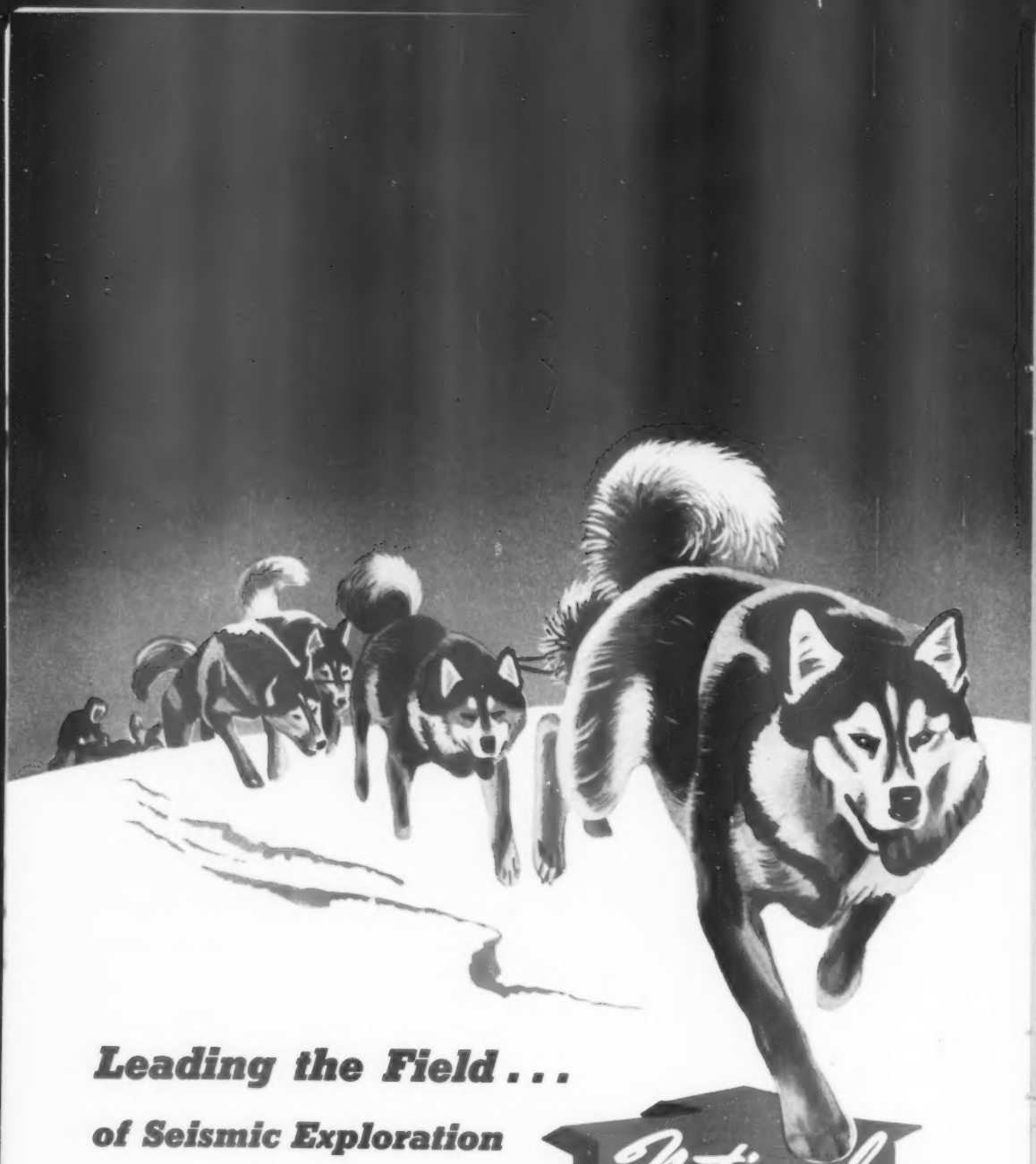

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EXPLORATION

Offshore Problem Still Unsolved

by Philip C. Ingalls

A CLEAR understanding of the seaward extension of the tremendous sedimentary wedge of the Gulf Coast area would be most desirable for the anticipated drilling program on the Continental Shelf.

From surface and subsurface work it is known that the post-Louann salt section along the northern coast of the Gulf of Mexico is probably 40,000 ft. thick. About 25,000 ft. of near-shore and shallow-marine sediments of Cenozoic age has been indicated by drilling and paleontological evidence and about 15,000 ft. of unknown Mesozoic rocks extrapolated from updip sections.

Individual stratigraphic units of Cenozoic and Mesozoic sediments thicken fairly constantly as they are traced downdip from surface exposures to the north until, near the coast, the dips increase, formations thicken rapidly, and the updip continental facies grade into near-shore and shallow-marine facies. Beyond this point little is known. It is what is believed to happen to the sedimentary prism southward from the present shoreline that was the subject of the American Association of Petroleum Geologists' symposium at the annual meeting in Houston.

At the present time there are two principal theories about this sedimentary section off Louisiana and the Upper Gulf Coast of Texas. Both theories have facts to support them, but neither can muster sufficient facts to prove it and discredit the other. The two theories are: (1) The present coast is a hinge line, and a deep but narrow trough, called the Gulf Coast geosyncline, exists along the northern shore of the Gulf of Mexico. (2) The present offshore area is just a continuation of land as far as the outer edge of the Continental Shelf where, at the continental slope, there was a zone of active movement in comparatively recent time.

The idea of the existence of the Gulf Coast geosyncline came into prominence during an A.A.P.G. meeting at Houston in 1933. A paper interpreted known geophysical and stratigraphic data to give evidence for the presence of a geosyncline hugging the north shore of the Gulf of Mexico. It was said that this deep, narrow trough was at least 10,000 ft. deeper than the floor of the gulf and that gulfward from the geosyncline the sediments thinned until only one-tenth of the thickness of the corresponding beds known at the shoreline is present on the bottom of the gulf. Drilling off the coast of Louisiana in recent years has shown that several of the stratigraphic units exhibit gulfward thinning. This thinning is believed to be on the southern limb of the geosyncline, the axis of which progressed gulfward as the basin subsided and its inland margins were uplifted.

Since 1933 there has been considerable additional geophysical work done—gravity, magnetics, and seismic profiling. The volume of this recent information is still insufficient for the desired picture and surveys are limited to only 25 miles or so off the Louisiana and Upper Gulf Coast of Texas and to no more than 2 miles at any other portion of the coast. However, this additional information indicates that there is no great irregularity in the basement near the coast or for some distance into the gulf. Furthermore, these surveys yield no evidence that the deep formations are not continuing to thicken and that the estimated 40,000 ft. of sediments at the coast is the maximum thickness. This line of thinking suggests that the Gulf of Mexico has been a deep sea but a comparativey short time ago and that its present depth beyond the Continental Shelf is due to down faulting. Paul Weaver, the principal advocate of this theory, points to the great thicknesses of carbonate rocks lithologically similar on the southern tip of the Florida Peninsula and the northern side of the Yucatan Peninsula as marking a stable threshold to the long shallow Gulf of Mexico.

It is generally recognized that the surface of the Gulf Coast seems to have remained nearly at sea level throughout post-Louann salt time. The near-perfect relationship of subsidence and sedimentation in the Gulf Coast area is difficult to explain. This problem has led to the theory that the weight of the sediments themselves caused the downwarping and that the geosynclinal axis, if such exists, shifted gulfward with each successive depositional cycle.

The problems associated with the existence of a Gulf Coast geosyncline will probably still be a good symposium subject for a Houston meeting in 1973.

HIGHLIGHTS OF WEEK'S DEVELOPMENTS

MONTANA . . . Shell Oil Co. recovered 5,000 ft. of 32.8°-gravity oil and 750 ft. of gas and mud-cut oil on drill-stem test from 8,247-98 ft. at 22-33 Unit, NW SE NW 33-10n-58e, on the Cabin Creek unit, Fallon County. The well previously had commercial tests in the Madison, the first of any significance in this formation along the Baker-Glendive anticline.

OKLAHOMA . . . A two-zone gas-distillate discovery 4 miles northwest of Edmond, Oklahoma County, has been shut in after a good flow from the second Wilcox and Simpson dolomite. The pool opener is Calvert Drilling Co. and Huffman & Malloy et al. 1 Salisbury, SW SE NE 13-14n-4w.

WEST TEXAS . . . First Strawn oil in any of the wells in or near Magutex field was found in Sharples 1 Means. The Andrews County well ran high on the Strawn compared with the Magutex discovery, and recovered clean oil on drill-stem tests between 10,962-11,010 ft., and at 11,000-60 ft. Stanolind Oil & Gas Co. 5 Fasken "F," Midland Farms-Ellenburger outpost test, flowed 35 bbl. of oil in 30 minutes on drill-stem test in the Fusselman at 11,875-11,968 ft.

NORTH DAKOTA . . . National Associated Petroleum Co. ran drill-stem test at 3,214-48 ft. at 1 Newhouse, C NE SE 3-162n-79w, Bottineau County, for recovery of 90 ft. of oil-cut mud and 150 ft. of mud-cut oil in the Charles formation.

New Lifter Roof

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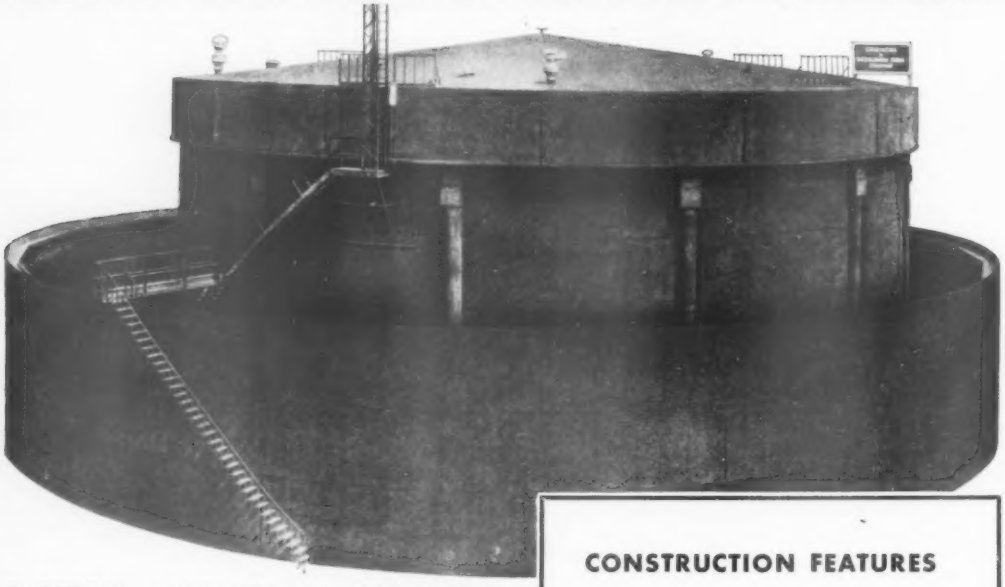

This 67,000-bbl lifter roof tank at South Boston, Mass., built by Bethlehem for White Fuel Corporation, has a diameter of 100 ft, and is 48 ft high. It is enclosed by a 142-ft-diameter fire-wall, 25 ft high.

There's no need for concern about loss of product through evaporation when you use the Bethlehem Lifter Roof. For this roof minimizes breathing losses by keeping the air-vapor rigidly controlled at all times.

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If you would like additional information about the construction and operating features of the Bethlehem Lifter Roof, write or call the nearest Bethlehem office.

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CONSTRUCTION FEATURES

1. The roof is cone-type, with two annular rings (dip ring and weather hood), outside the tank shell.
2. The circumferential trough (seal ring) at the top of the tank shell contains a sealing liquid which permits free movement of the dip ring, and also provides a continuous gas-tight seal.
3. The dip ring operates in the circumferential trough at the top of the shell.
4. The outer ring is a weather hood. It keeps dirt, rain and snow out of the circumferential trough.
5. Any condensate collecting in the bottom of the sealing trough gravitates to the bottom of the vertical stiffeners where it can be drained. This is of special importance in cold-weather areas where water in the sealing liquid could freeze and cause operational failure of the lifter mechanism.
6. The vertical stiffeners not only act as a collecting reservoir for the condensate, but also provide essential strength and stiffness in the tank shell.
7. The guides are entirely inside of the roof and seal, and therefore cannot be rendered inoperative because of the formation of ice.

BETHLEHEM STEEL

BETHLEHEM STORAGE TANKS

Arrows point to five faintly visible rigs in Magutex area.

DEEP PRODUCTION IN

West Texas' Magutex Field Shapes Up

Discovery of productive structure attributed to combination of subsurface and seismic work.

by Roy F. Carlson
West Texas District Editor

ONE of the newest fields in the series that have been developing off the flanks of the Central Basin platform in the deeper parts of the Midland basin is Magutex, currently a three-well field drilled by Magnolia Petroleum Co. on University of Texas land. Two wells are now drilling in the field.

The discovery well was finaled on May 20, 1952, in the Ellenburger with a natural flowing potential of 556 bbl. per day through a ½-in. choke. The well was Magnolia's University No. 36994-1. Total depth drilled was 13,918 ft. although the well was later plugged back to a depth of 13,892 ft. with the top of the pay called at 13,840.

Total depth of this well is comparable to other Ellenburger fields in the Midland basin, and tops of higher pays are found at depths of the same degree of magnitude as in other of the deep fields. Tops of higher formations in neighboring wells also coincide closely with Magutex tops.

Location of Magutex field is shown on the accompanying map, with other nearby deep wells lettered. The area shown is in the south central part of the northeast one-fourth of Andrews County, about 11 miles northeast of the town of Andrews, Tex., on University Lands, Block 8.

Discovery of the structure which later proved to be productive is attributed to a combination of subsurface and seismic work. A high, indicated by subsurface information, was later shot out and the subsurface work was confirmed. Drilling of the discovery well began August 30, 1951, and the official potential of the well was taken May 20, 1952. During the drilling, 26 cores were taken, and 23 drill-stem tests were conducted.

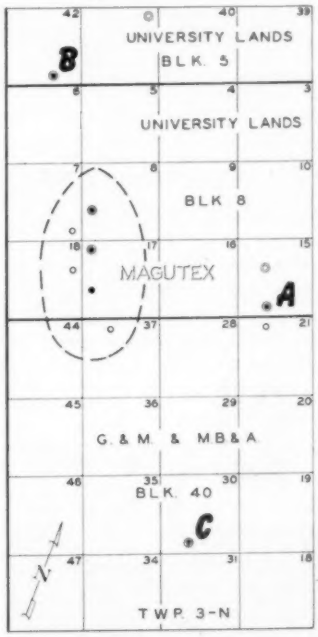

Fig. 1—Magutex area well-location map.

The highest core cut was in the Spraberry sand, and the first drill-stem test was taken in the Spraberry. The various drill-stem tests and core and sample information indicated the presence of oil or gas in the Spraberry, Mississippian, Devonian, and Ellenburger. Completion of the Magutex wells has been in the Ellenburger, although other nearby wells have completed in the Devonian.

A drill-stem test of a section of the Devonian in the Magutex discovery flowed 122 bbl. in 2¼ hours. Another test of a lower 24-ft. section recovered 42 bbl. in 1½ hours. No water was recovered on either test. These tests show rather conclusively that the Devonian would be commercially productive in Magutex field.

Drill-stem tests of the Ellenburger prior to completion flowed oil at rates varying from 28 to 81 bbl. of oil per hour. A test of the bottom section to the total depth of 13,918 ft. recovered some water. This section was later cemented off in plug-back operations. The discovery made its 556 bbl. per day through a ½-in. choke on official potential test, flowing naturally. The other two wells made about 90 and 500 bbl. each after treatment with acid. The well farthest to the north

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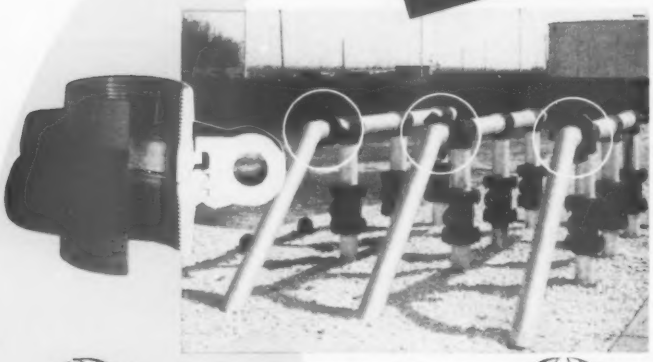

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makes some salt water, although the source of that water is unknown.

Oil from the Magutex wells is sweet and of high gravity, varying from 48.5° to 53.6° A.P.I. Gas-oil ratios have been measured from 300 to 400 cu. ft. per bbl.

The Ellenburger in Magutex field is a highly fractured brown dolomite. Porosity and permeability are high. The reservoir is formed in a structural high, the limits of which have not been established. No faults or lithologic discontinuities are apparent. A tentative water table has been picked at —10,887 ft. in the discovery well, although this might be questionable. The pay section is about 50 ft. thick.

Early estimates of the Ellenburger reservoir in Magutex have it covering about 4 sq. miles, according to data from seismic results, but only future drilling will pin down the areal extent. The Magutex Ellenburger structure appears to be separated from any indicated Ellenburger production nearby.

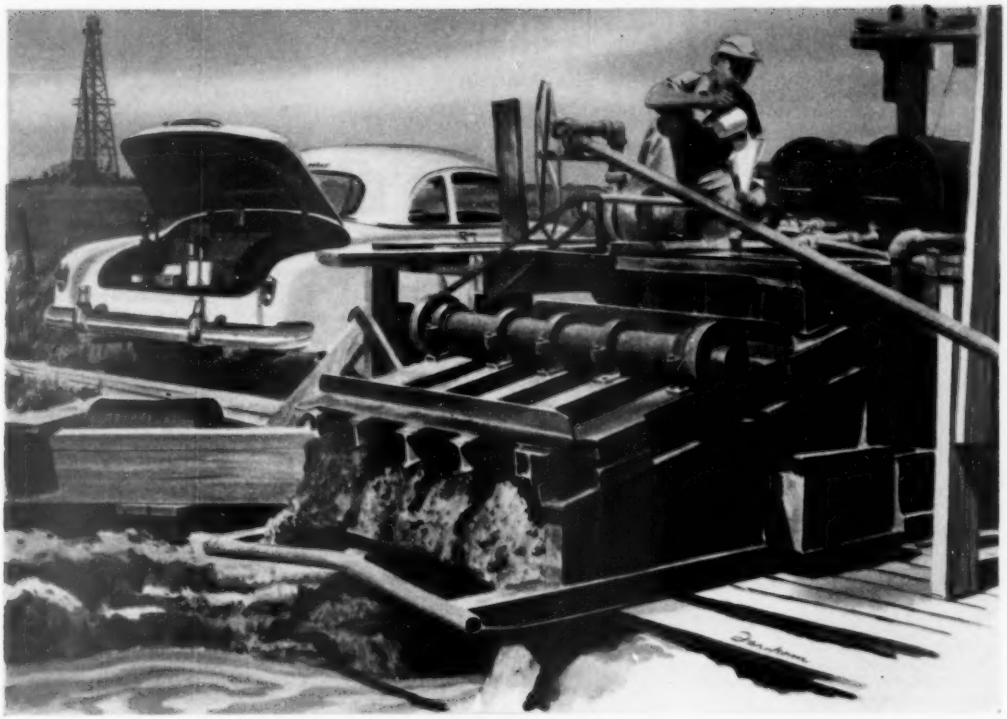
However, these same estimates indicate that the Devonian may be continuously productive over a wide area, including presently producing Devonian wells as shown on the accompanying surface map. This is indicated particularly in the case of the Humble University "Q" Devonian well (A on map) and Phillips "CC" Devonian well (B on map). The Ellenburger top in Magutex field drops toward the Phillips well, the highest well being the most southerly well. This is the poorest well of the three from a productive standpoint.

The Phillips "CC" well tested the Ellenburger and found oil but on testing the formation produced a large amount of water also. It was plugged back and recompleted in the Devonian, producing 2,300 bbl. of oil per day through ½-in. choke on potential test. The Ellenburger top ran low to that in the Magutex discovery. The Devonian top is almost flat with the Magutex Devonian tops. Devonian production reportedly will be continuous to Magutex field.

The Humble "Q" was completed in the Devonian, and appears to be high to the Devonian in Magutex, topping that formation at —9,442 ft. Continuity of production between this well and the field is said to be questionable. It is reported that a saddle exists between the well and the field according to geophysical information. Whether or not this saddle is pronounced enough to cause a discontinuity of production between the two is uncertain. The distance between the two is only a little more than 2 miles.

The Humble well is being offset by a well currently drilling by Magnolia Petroleum Co.

The Magnolia 1 "CA" Fasken south-



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east of Magutex field (C on map) was completed early this year in the Devonian, the top of which is at a subsea datum of 9,705 ft. It is a bit over 3 miles from production in Magutex, and topped the Devonian 200 ft. low to the Magutex discovery.

The Devonian pay is about 50 ft. thick on the average, and produces a high-gravity oil. Penetration of the Devonian varies in these wells from 25 to 75 ft.

Magutex field is too new to have much of a production history; however, through January 1953 the field had produced 74,817 bbl. of oil, with two wells producing 251 bbl. per day during January 1953.

Stratigraphic Section at Magutex

Ground elevation, 3,025 ft., loose sands and caliche are found at surface.

Rustler anhydrite, topped at 923 ft., one of the identifiable rocks in the red bed-anhydrite section typical of West Texas.

Cowden anhydrite, topped at 45 ft., another anhydrite section, not often differentiated from the other parts of anhydrite-red-bed section.

Yates, topped at —215 ft., red sand, shale, frosted quartz grains.

Grayburg, topped at —1,644 ft., anhydrite at top with dolomite and limestone.

Leonard, topped at —4,028 ft., predominantly lime with some brown and black shale above top of Spraberry.

Spraberry, topped at —5,459 ft., sandstone or siltstone with some lime; lime and shale section above Wolfcamp top.

Wolfcamp, topped at —6,767 ft., fossiliferous brown shales and black lime.

"Strawn," topped at —7,914 ft., medium crystalline creamy lime, fossiliferous, with some chert and shale.

"Bend," topped at —8,302 ft., lime with black shale above Mississippian top.

Mississippian lime, topped at —9,035 ft., siliceous gray to brown lime with chert near top; some stringers of black shale.

Woodford, topped at —9,429 ft., brown flaky shale containing fossil spores.

Devonian, topped at —9,502 ft., limestone with some chert and dolomite.

Fussleman, topped at —10,167 ft., limestone and dolomite with some chert.

Montoya, topped at —10,396 ft., limestone with frequently a lot of chert.

Simpson, topped at —10,640 ft., primarily green and black shale, sandstone, and at base the "Joins" dolomite.

Ellenburger, topped at —10,803 ft., dolomite, tan to brown, vuggy and fractured.

CALIFORNIA

Tide Water Has Possible Kern County Discovery

Tide Water Associated Oil Co. has set 7-in. casing in a wildcat 5 miles northwest of Lost Hills field, Kern County, after running electric log and making a 1-hour formation test at 2,715-69 ft. Results of the test were not revealed, but the pay is believed to be the equivalent of the Pliocene sands which produce at Lost Hills.

The wildcat, 14-17 Farnsworth, is located in SW NW 17-25s-20e. Drilled to 2,769 ft., casing was set at 2,720 ft. The test is on the eastern edge of a string of dry holes in the township along the Lost Hills-Kettleman Hills trend. Nearest dry hoe is a 4,000-ft. Tide Water test about ½ mile southwest.

New San Joaquin Valley Tests

About 1½ miles northwest of Union Oil Co.'s recent Tecuya sand discovery at Tejon Flats, J. V. Dougherty and associates have staked a new test. It will be drilled in NW SE 14-11n-19w, and will be carried to basement unless the Oligocene or other pay is encountered. The wildcat will be drilled on Reserve Oil & Gas Co. property at Tejon Ranch.

Within the next 3 months Humble Oil & Refining Co. will start a deep test at Bacon Hills, with the wildcat scheduled to be drilled in 27-28s-20e. Proposed depth of the test, which will be on acreage recently acquired from Mitchell et al, is about 12,000 ft.

In the Moda area of Glenn County, Humble had started 1 Moda unit in 1-22n-2w. The wildcat is about 7 miles east of the town of Orland and 8 miles northwest of the Ord Bend gas field.

South Tapo Activity

Terry Drilling Co. was in process of completing its second well, 3 Tapo, in the 2,400-ft. Luisian (upper Miocene age) sand its 2 Tapo opened in February. Located in NE NE 13-3n-18w, Ventura County, the east offset topped the sand at 2,150 and was bottomed at 2,340 ft. where 7-in. casing was set. Terry's first well and a north offset by Union Oil Co. were completed as 700-bbl. producers.

The new Luisian pool is adjacent to two 400 to 500-ft. producers completed in 1950, now abandoned, which also were thought to be producing from Luisian sands. Consequently it is believed that faulting exists south of the Terry discovery, with the down throw on the north, in which a vertical displacement of about 1,500 ft. took place.

Terry was preparing to start 5 Tapo as a northeast offset to the discovery and northeast of this location, in SE SE Section 12, Union had set pipe in 2-12 Simi.

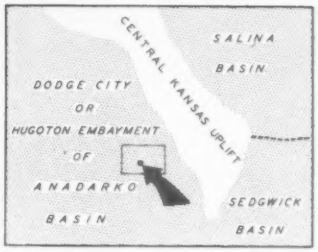
KANSAS

Rank Hodgeman Prospect Recovers Oil in Marmaton

The rank wildcat area of the Hugoton embayment of southwestern Kansas has a new indicated discovery.

Atlantic Refining Co. recovered oil from two zones in the Marmaton of Pennsylvanian age at 1 Hall, C NW SE 36-23s-22w, Hodgeman County, 14 miles east of Purdyville pool. A drill-stem test at 4,283-4,317 ft. recovered 3,390 ft. of free oil. Another at 4,434-55 ft. recovered 140 ft. of oil and gas-cut mud, 60 ft. of muddy, gassy oil, and 120 ft. of clean 40.2°-gravity oil. A drill-stem test at 4,568-4,608 ft. in the Mississippian recovered 340 ft. of salt water, and another at 4,680-4,708 ft. recovered 110 ft. of mud. The operator is drilling ahead at the wildcat.

The indicated discovery is located in the sparsely productive Hugoton embayment. This embayment includes the area between the Las Animas arch in eastern Colorado and the Central Kansas uplift, and is the northerly extension of the Anadarko basin which covers an area of about 35,000 square miles in western Oklahoma, the Texas Panhandle, and southwestern Kansas. The deepest part of the Kansas portion of the southward dipping



Arrow indicates rank Hodgeman County Marmaton prospect.

basin is in Comanche County where thick sections of Mississippian and Pennsylvanian rocks are found.

The Hugoton embayment had a concentrated, active wildcatting and development program in 1952, a program that has continued strong this year. Meade and Clark counties, Kansas, and those counties of the Oklahoma Panhandle had 18 new oil and gas discoveries last year. The same area had four new strikes so far this year. Last year's discoveries were made in the Pennsylvanian-Oswego lime, Marmaton, and Lansing lime zones as well as in the deeper Morrow and Mississippian rocks. Exploration in the northern end of the embayment in western and northwestern Kansas was widely scattered.

The few discoveries last year and this first 3 months of 1953 suggest opportunities for uncovering more important producing areas in the Kansas portion of the Anadarko basin. Gove, Hodgeman, and Finney counties, in the heart of the Hugoton embayment, report the largest amount of current wildcat activity. Hodgeman County has two small producing areas, Jetmore and Purdyville, but only one oil well was completed in the county last year, while 18 wildcats were unsuccessful.

New Pratt Pool Opened

A new oil pool is being opened in the northwestern corner of Pratt County on the southern end of the Central Kansas uplift at Tatlock Oil Co. and Lion Oil Co. 1 Curtis, SE SE NE 21-26s-15w, 11 miles west of Chance pool. The indicated new pool is just southeast of the town of Hopewell, Kans.

Committee Names New Pools

The Nomenclature Committee of the Mid-Continent Oil & Gas Association has named 11 new oil pools in 8 Kansas counties.

Central uplift . . . New oil pools on the Central Kansas uplift total nine. Barton County has three new pools, Hampel, opened by Northern Pump Co. 1 Hampel, NW NW NW 34-17s-15w, Zimmer pool, opened by Great Bend Brick & Tile Co. 1 Werhahn, SE NW SE 28-19s-15w, an Arbuckle produced in the process of completion, and Fleske pool, opened by Harms & Knight 1 Fleske SW SW NW 3-20s-15w, in process of completion from the Lansing. Ellis County has two new oil pools, Holy Cross and Wheatland Southwest. Holy Cross was opened by Carl Lebsack 1 Holy Cross, SE SE SE 26-12s-18w, a Lansing producer, while Wheatland Southwest is in process of completion in the Arbuckle by Peel-Hardman Oil Producers 1 Dumler, SW SW SW 19-15s-17w. Rooks County has one new pool, Colby, opened by Trans-Era Petroleum, Inc. 1 Colby, NE NE SW 27-10s-17w. Colby is a Lansing producer. Russell County, Stafford and Trego each has one new pool, Fossil Creek, Radke, and Spaulding, respectively. Fossil Creek

was opened by Murfin Drilling Co. 1 Boxberger, NE NE NE 11-14s-14w, in the Tarkio. Radke was opened by Westgate-Greenland Oil Co. 1 Radke, NW NW NW 25-23s-14w, a Lansing producer. Spaulding was opened by Imperial Drilling Co. 1 Spaulding "B," NW NW NE 1-11s-21w, also a Lansing producer.

OKLAHOMA

Cushing Skinner Strike Shut in After Flow

A new Skinner sand discovery 1 mile west of Cushing in Payne County, northeastern Oklahoma, has been shut in after an initial flow from the treated sand pay.

The well flowed 60 bbl. of load oil in 1½ hours with a good gas blow and spray of new oil. The well has been shut in for tank connections. The flow came from perforations at 3,552-60 ft. after fracturing treatment.

Deep Drilling Continues In Cleveland County Area

South central Oklahoma's deep oil search is continuing at a rapid pace with good showings reported in Cleveland County wildcats.

McAlester Fuel Co. 1-A Todd, C NW SW 11-9n-3w, northwest of Norman, found light stain and fluorescence in cuttings from the Bois d'Arc limestone on a drill-stem test from 8,620-70 ft. Recovery was a 900-ft. water cushion and 30 ft. of slightly gas-cut mud.

North of the city of Norman at Continental Oil Co. 1 Lessly, SW NW SE 9-9n-2w, operator is drilling below 8,205 ft. in the Oil Creek sand with stain and odor.

Activity Up in West Mosquito Creek Pool

Activity in central Creek County's West Mosquito Creek pool has picked up considerably since last year's new pay discovery, the Wilcox, was added to the field's Prue sand production.

C. D. Coffield et al 3 Kelly-Harring, SE SW NW 21-17n-8e, made 600 bbl. of oil per day through open tubing from the Wilcox sand open hole at 3,488-90 ft. after fracturing treatment to become the pool's latest Wilcox addition.

Thompson & Lee 2 Kelly-Harring, NW NW SW 21-17n-8e, opened the Wilcox pay in the field in November. The company has one other well drilling in the area with four other locations to be drilled.

Eola Has New Pay

Garvin County's multizone Eola field has a new pay, a rich Oil Creek sand section.

The new pay opener is Sohio Petroleum Co. 1 Franklin "B," SE NW SW 7-1n-2w. The basal Oil Creek sand flowed at the rate of about 86 bbl. of 40°-gravity oil per hour on drill-stem tests from 9,290-9,348 ft.

The new discovery will push development northward from Eola pool to fill the gap between pool and stepout production. Sohio also added Hunton lime production at 1 Freeman, NE SW SE 7-1n-2w. The well flowed 182 bbl. of oil per day on ¼-in. choke from the Hunton perforations at 6,258-90 ft.

Stanolid Oil & Gas Co. 1 McKey, SE NE SW 12-1n-3w, is a McLish find. The well was gaged for 12,500 M.c.f. of gas per day and recovery of 200 ft. of distillate was made on a drill-stem test from 10,030-70 ft. The 1 McKey is a west extension.

Northwest Edmond Discovery Shut In After Good Flow

A two-zone gas-distillate discovery 4 miles northwest of Edmond in Oklahoma County has been shut in after a good initial flow.

The new pool opener, Calvert Drilling Co. and Huffman & Malloy et al. 1 Salisbury, SW SE NE 13-14n-4w, flowed through a 25/64-in. choke at the rate of 100 bbl. of distillate and 10,000 M.c.f. of gas per day from perforations in the second Wilcox sand at 6,658-62 ft. and at the rate of 8,000 M.c.f. of gas per day with a distillate spray from the Simpson dolomite perforations at 6,450-6,500 ft.

Fourth Zone at McClain Test Is the Oil Creek Sand

The fourth indicated pay zone for the new McClain County discovery at Jay Simmons 1 Ray Wilson, C SE SE 14-8n-4w, has been reported.

The Oil Creek sand had a recovery of 570 ft. of distillate, mud-cut distillate, and distillate and gas-cut mud on drill-stem test at 10,935-64 ft. The indicated discovery previously showed pay zones in the Tulip Creek sand, Bromide sand, and the Hunton lime.

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ROCKY MOUNTAIN

Shell Discovery Tests Second Pay Zone

Recovery of oil from a second apparently commercial zone in Shell Oil Co.'s Cabin Creek unit discovery in Fallon County has added to the already considerable importance of this Williston basin discovery.

The well is 22-23 Unit, NW SE NW 33-10n-58e. Test from 8,247-98 ft. recovered 5,000 ft. of clean 32.8°-gravity oil and 750 ft. of gas and mud-cut oil, with tool open 2½ hours. Gas flowed after 10 minutes of the test at the estimated rate of 100,000 cu. ft. per day. Flowing pressure during the test was 320-1,430 psi., and shut in pressure after 1½ hours was 3,780 psi.

The formation has not been identified by the operator, but is believed to be Devonian. The wildcat is just south of Shell's Pine Unit field, rapidly developing into one of the better fields in the Montana portion of the Williston basin. Production at Pine Unit is identified as from Silurian and Ordovician formations. A possible third producing horizon is indicated for the Cabin Creek wildcat in the Ordovician.

The wildcat produced commercial quantities of gas from Charles of Mississippian age, and also recovered large quantities of oil on test of Madison lime, where the saturated section is reported to be nearly 400 ft. in effective thickness. The discovery is the first of importance in Mississippian formations on the Baker-Glendive anticline.

There was no water recovered on the most recent test. Production at Pine Unit is characterized by some water recovery with the oil. At the Cabin Creek wildcat Shell is reported at 8,299 ft. attempting to free stuck drill pipe.

North of the Cabin Creek area Montana's deepest well is drilling below 12,904 ft., nearing its Ordovician objective estimated at about 13,000 ft. The well is Sun Oil Co. and Phillips Petroleum Co.'s joint venture, 1 Dynneson, C SW NE 32-42n-58e, in Richland County, northwest of the town of Sidney.

There were two new locations of interest announced in the Montana portion of the Williston basin during the current week. Empire State Oil Co. has location for 1 Smith "C," SW SW 8-29n-51e. 2 miles north of nearest production at East Poplar field in Roosevelt County. In the Buffalo area 4 miles west of the Southwest Richey discovery Shell Oil has made location for 22-25 "A" NPRR, C SE NW 35-22n-47e, in McCone County.

West of the Williston basin area of Montana, Continental Oil Co. has announced location for an 8,600-ft. test to Ordovician at 1 NPRR, SE SE NE 9-9n-17e, on the North Nihill block in Wheatland County.

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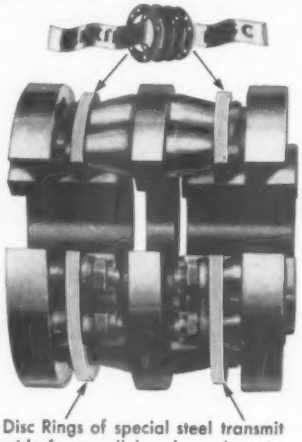

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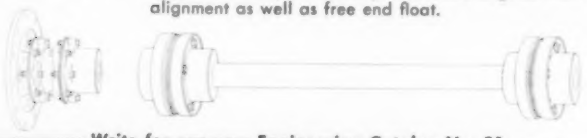

Write for our new Engineering Catalog No. 51

THOMAS FLEXIBLE COUPLING COMPANY
WARREN, PENNSYLVANIA, U.S.A.

WYOMING

Two Wyoming Discoveries At Completion Stages

George J. Greer, Trustee, of Dallas, has reported a flow of 75 bbl. of oil per day from 2 Government, NE SE NE 22-55n-97w, in the Coon Creek area of Big Horn County. The well is a recent discovery in an area where Stanolind Oil & Gas Co. drilled a failure a year ago. The wildcat produced from first Frontier perforations from 4,612-33 ft., and test followed sand-oil squeeze of the formation. Testing is continuing on this wildcat, with the current gage better than indicated on early drill-stem tests.

Crook County's first commercial oil well has been completed by True & Brown et al of Casper and Denver. The well is 1 Stevenson, C NE SW 5-49n-68w, and production from the Dakota sand was at the rate of 30 bbl. of oil and 10 bbl. of water per day. Completion at this gage followed early swab tests which had indicated a production of as much as 100 bbl. of oil per day. A second well in the area is now nearing completion.

COLORADO

Denver-Julesburg Deep Wildcat Nearing Test

Sherrod & Apperson's apparent Permian discovery at 8 Gillette, C NW NW 9-9n-61w, in Keota field, Weld County, is reported at total depth of approximately 9,620 ft. and information released by the operator indicates that casing will be run for attempted completion in the Lyons (?) sand zone which showed apparently commercial quantities of oil on drill-stem test from 8,489-99 ft.

The wildcat is of importance as the first to recover oil in commercial quantities from formations older than Cretaceous in the Denver-Julesburg basin. Complete details have not been released by the operator, and the well is still operated as a tight hole.

WESTERN NEBRASKA

Discoveries Indicated in Kimball, Cheyenne Counties

Two western Nebraska independent operators are testing apparent discoveries in Kimball and Cheyenne counties. At 1 Thompson, NE NW SE 12-14n-51w, Cheyenne County, James P. Sloss recovered 840 ft. of oil and

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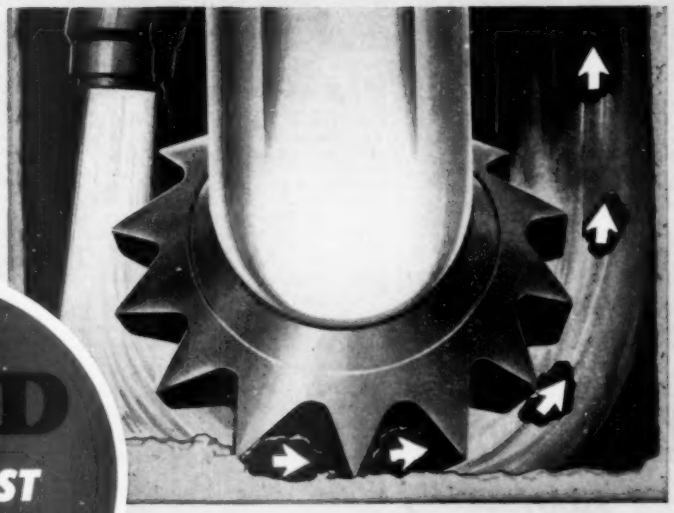

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100 ft. of fresh water under flowing pressure of 325 psi. from the zone 4,744½-53 ft., with tool open 2 hours. The wildcat is about 5 miles west of Huntsman field, in an area which has had considerable wildcat activity during recent months. Production is from the "D" sand and the operator is reported coring below 4,573 ft. and will carry the well to "J" sand.

At 1 State, SE SE NE 16-13n-53w, ¾ mile southwest of Southwest Potter field in Kimball County, Rogers Oil Co. of Scottsbluff, Neb., recovered 630 ft. of high gravity green oil on test of the zone 5,586-5,606½ ft. Tool was open 1 hour, with gas at the surface at an unestimated rate after 10 minutes open time. This discovery is also in "D" sand, and the operator will continue drilling to test "J" sand.

TEXAS

WEST TEXAS

Ector County Well is New Discovery

Cities Production Corp. and Union Oil Co. of California 1-E Cross, Ector County wildcat, has established good flowing production from the San Andres. Location of the wildcat in 44-43-T2S-T&P is about 2 miles southwest of a new Pennsylvanian area, and the same distance west and north of San Andres production on the southwest tip of South Cowden.

Drill-stem test in the 1-E Cross from 4,280-4,350 ft. flowed oil at the rate of 20 bbl. hourly, and 16-hour completion test of 229.6 bbl. through 26/64-in. choke, rated a calculated daily potential of 344 bbl. Final test was from open-hole pay at 4,255-4,340 ft., total depth.

Cities Production 1-D Cross, west of Pennsylvanian production, was running electrical surveys to 4,877 ft., and the company's 1-C Cross was drilling below 10,001 ft.

V. A. Brill 1-A Fasken, northwest of the MacBoring-Wolfcamp field, was drilling below 12,234 ft.

Gulf Oil Corp. 721 Goldsmith, deep test in the Goldsmith field, failed to find commercial production in drilling to 10,339 ft., in dolomite, but plugged back to make a good flowing well from perforations between 6,190-6,300 ft. On 24-hour test, the well tanked 254 bbl. of oil.

Texas Gulf Producing Co. 2 Headlee second test for the new Ellenburger pool in Ector County, reported sample top on the Devonian at 11,340 ft. On elevation of 2,917 ft., that marker was 123 ft. high to the discovery. Operators were coring ahead below 11,639 ft. in porous lime, and still in the Devonian. Soft lime was cored from 11,570-603 ft.

Magutex Development

In Andrews County, Magnolia Petroleum Co. 1-36996 University, ⅜-mile southwest offset to the Magutex discovery, flowed 19 bbl. of oil in 1 hour on drill-stem test of the Devonian from 12,506-45 ft. Flowing oil reached the top in 2 hours and 40 minutes. Top of the Devonian at 12,498 ft., on estimated elevation of 3,038 ft. gives it a minus datum point of 9,460 ft., compared with minus 9,519 ft. on the same marker in the Magutex discovery.

Magnolia's Magutex discovery had flowing oil from the Devonian at 12,554-72 and 12,572-97 ft., but completed in the Ellenburger. Nearest Devonian oil to the southwest offset is 2½ miles to the southeast in the new Hutsex pool.

Phillips Petroleum Co. 1-RR University, northwest extension attempt to a Devonian discovery, was circulating for samples at 13,810 ft.

Schleicher Discovery is Good

R. W. Berry et al 1 A. B. Thomerson, Strawn discovery in 65-H-GH&SA, extreme northern Schleicher County, completed for 210 bbl. of 40° oil a day from perforations at 5,288-97 ft. The daily gage was based on an 8-hour flow of 70 bbl. of oil through 7/16-in. choke. Top of Strawn was 5,208 ft., minus 2,784 ft. Top of porosity was 5,218 ft., and water table was at 5,309 ft.

NORTH TEXAS

Ellenburger is New Pay In Grayson Pool

Ellenburger oil in the Mackey-Strawn field of northwest Grayson County has been established by Seitz, Comegys & Seitz 2 Mackey, John Bridtes Survey, A-127, 3 miles southeast of Whitesboro. On completion test the well flowed 196 bbl. of low-gravity oil a day through 18/64-in. choke, from perforations at 5,118-38 ft. Strawn sand pay in the pool is around 3,800 ft.

Superior Oil Co. of Houston has made application to drill 1 Cooper as a 10,000-ft. wildcat 5 miles southeast of Whitesboro. Location is approximately 1 mile east of the Sadler-Pennsylvanian field.

Humble Oil & Refining Co. 1 Mark Williams, deep wildcat 3 miles northwest of Sandusky, was drilling in shale at 13,980 ft. It is North Texas' deepest operation.

Magnolia Petroleum Co. 1 J. F. Godwin, deep exploration 4 miles south of Gordonville, was reported dry at 12,145 ft., total depth. Last drill-stem test was from 12,129-45 ft., which recovered slightly gas-cut sulfur water.

Development work in the Webb Oil Creek field 7 miles northeast of Whitesboro included the completion of Mid-Continent Petroleum Corp. 2 Carson, in the J. Barefoot Survey, A-90. Potential was 541 bbl. of 41° oil a day through 16/64-in. choke from perforations in sand at 7,089-7,150 ft.

British-American Oil Producing Co. 1 Swank, rank wildcat in the northwest corner of Foard County, attempted a drill-stem test in the Caddo lime at 6,265-85 ft. but failed due to mechanical troubles. Top of the lime was 6,260 ft. on elevation of 1,350 ft. Operators cored dense lime bleeding oil from 6,295-6,310 ft. Stuck drill pipe prevented a test at 6,353-90 ft., and drilling continued below 7,100 ft.

TEXAS PANHANDLE

Rapidly expanding Quinduno field in Roberts County in the Texas Panhandle continues to be that area's most active spot.

Creslenn Oil Co. 3 Edge, Section 167, Block M-2, BS&F Survey, had a flowing potential of 275 bbl. of 50-gravity oil per day from the Brown dolomite topped at 4,090 ft. Shamrock Oil & Gas Corp. 5 Maddox, Section 158, Block M-2, was rated for 233 bbl. of 53°-gravity oil per day, and Gulf Oil Corp. 1 McCuistion "A," Section 193, Block M-2, was finaled for 80 bbl. of 50-gravity oil per day. Gulf's 2 McCuistion, Section 193, Block M-2, was finished for 98 bbl. of oil per day.

The field now has almost 20 producing wells. Development is on a 40-acre pattern. The field was opened early last year and now is the Panhandle's most active development area. Most pay in the field is from the Brown dolomite. One well has pay from the granite wash.

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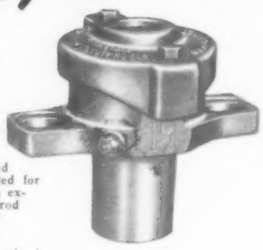

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EAST TEXAS

Shallow Pool Opened In Freestone County

Bradley & Sherar 1 R. V. Bounds, originally started by W. A. Reiter, has completed as a Nacatoch sand producer, and offset development is under way.

Top of sand in the discovery was 950 ft., casing was set at 952 ft. and drilled out to 979 ft. Completion potential was 22 bbl. of 24° oil a day through ½-in. choke.

Confirmation well to the discovery was drilled and completed soon after the first well. Coffield & Guthrie 1-A Boyd, a long southwest offset, found pay sand at 976 ft., drilled to 1,027 ft. and completed on the pump for 30 bbl. of oil a day.

Two additional wells will be drilled by Bradley & Sherar. These will be the 1 Clyde Boyd and 1 Adams-Boyd, both in the W. H. Stone Survey, A-760, which overlaps into Navarro County, approximately ½ mile west of the discovery.

Kaufman County Prospect

Discovery or extension production was expected at Peveto & Cooper et al 1 C. P. Williams, northeast of Humble Oil & Refining Co.'s East Gossett field discovery. Drill-stem test at 3,260-68 ft., open 15 minutes, had gas in 7 minutes and recovered 200 ft. of oil, plus 690 ft. of water. Operators were running casing to shut off water.

Humble has staked location for a Travis Peak wildcat in the area of its 1 McWaters, 1949 discovery of the Freestone pool. The new test will be 1 F. G. Farrell, in the T. L. Newman Survey, A-467, 2 miles southwest of Freestone townsite. Proposed depth will be 8,700 ft.

TEXAS GULF COAST

Helen Gohlke West Field Adds Good Oil Producer

Sun Oil Co. has completed another good oil producer in the Helen Gohlke West field, in Victoria County, at its 5 Kuester. It is a link in proving up the area between the field proper and Sun's recently completed extension well, 4 Kuester, a mile southwest of the field.

The new well, on potential gage, flowed 204.51 bbl. of 32.3°-gravity oil in 24 hours through ¼-in. choke with 1,095 psi. pressure on the tubing and gas-oil ratio of 638 cu. ft. per barrel. The field's Yegua pay is open through casing perforations at 8,115-23 ft.

Sun has another well drilling near pay level at 1 Friar, 1,100 ft. further southwest of the recent extension well, and is starting another 1,320 ft. south of the latter at 6 Kuester.

Extension Well Opens New Pay at North Delhi

The spreading North Delhi field in Harris County is being extended another 1,320 ft. northward with a well being completed by F. A. Callery, Inc., at 2 Tucker, in Section 30, HT&C Survey. The well, to be completed as a dual-zone producer, not only confirms oil production found in a 6,780-ft. sand at a recently completed well a mile north of the field proper, but is opening a new gas-condensate sand around 6,480 ft.

Tested first in the new upper sand, opposite which casing is perforated at 6,482-86 ft., the well flowed at an estimated rate of 3,000,000 cu. ft. of gas per day through 12/64-in. choke with 2,350 psi. pressure on the tubing. No estimate on condensate production was reported. Casing then was perforated in the lower oil sand at 6,782-95 ft. and flowed 125 bbl. of 40.3°-gravity oil per day through ¼-in. choke with tubing pressure of 1,200 psi.

SOUTHWEST TEXAS

New Pay at Tabasco

Another producing zone has been added to multi-pay Tabasco field in Hildalgo County with the completion by Houston Oil Co. and American Republic Corp. of their 9 West, located in Porcion 74. The new pay is open through casing perforations at 5,045-51 ft., from which the well flowed 163 bbl. of 45.3°-gravity oil on a 24-hour gage through 9/64-in. choke with tubing pressure of 800 psi. Hole was drilled to 7,506 ft. and has casing to 5,105 ft.

ARKANSAS

West Fouke Field is Now Tri-Producing Zone Area

Miller County's West Fouke field in the extreme southwestern part of Arkansas now produces from three zones, the upper Paluxy, Paluxy, and the Tuscaloosa.

Jay Simmons 1 Dildy-Wiegel-Willis unit, NE SW NW 21-17s-27w, is the new pay opener in the field. The well flowed 144 bbl. of 33°-gravity oil per day from perforations at 3,720-30 ft. in a sand believed to be of the upper Paluxy. Murray Petroleum 2 H. T. and Lorena Wiegel, C SW SE NW 21-17s-27w, has production assured for a confirmation to the new pay sand.

The field discovery well, Simmons 1 Dildy, N½ SW NW 21--17s-27w, produces from 4,302-06 ft. in the Paluxy. Murray opened Tuscaloosa pay in the field at 1 H. T. and Lorena Wiegel, C NW SE NW 21-17s-27w. Production from the Tuscaloosa at that well was at 3,582-85 ft. This was the best well to date in the new field.

Casing Set at Springhill Hill Test in Columbia

Hunt Oil Co. has set 7-in. casing at 5,189 ft. to test the Hill sand at 1 Dennis, Section 10-20s-23w, Springhill field, Columbia County.

A drill-stem test at 5,125-47 ft. recovered 120 ft. of gas-cut mud with oil traces. The new test lies 3,025 ft. west of the recent Hill

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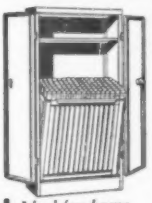

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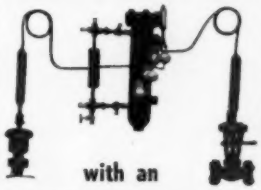

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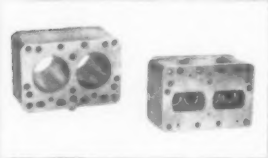

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sand discovery in Springhill field at Hunt's 2 Dennis, Section 11-20-23w. On the Louisiana side of the field Phillips & Stephens were coring to the Tokio at 1 Grafton, Section 2-23n-11w, Webster Parish, another Hill and Pettit test. Regular pay in the field is the Tokio.

East Lisbon Area Strike Has Confirmation Staked

The recent discovery of a new Cotton Valley reservoir in the area east of old Lisbon field, Union County, has a west offset and confirmation attempt staked.

Don D. Montgomery and Associates have staked location for the west offset to the 1 Brasher, C SW NE Section 14-17s-16w, discovery well. The offset 1 Milner heirs, Section C SE NW 14-17s-16w. The 1 Brasher was completed flowing 120 bbl. of oil per day from 4,941-50 ft. in the Cotton Valley, opening East Lisbon pool.

LOUISIANA

SOUTH LOUISIANA

Deep Terrebonne Wildcat Ignites After Blow-out

A deep wildcat test being drilled by Tide Water Associated Oil Co. 2 miles northwest of the Houma gas field, in Terrebonne Parish, blew out early the past week, ignited, and over the weekend still was blowing out of control.

The test, 1 Southdown Sugars, in 101-17s-17e, started to kick when drilling through a high-pressure gas sand at 13,351-56 ft. Hole was deepened to 14,365 ft. when the well blew out, making an undetermined volume of gas. The well ignited 2 days later, but has not cratered. Drill pipe still is in the hole.

Crews of M. M. Kinley, oil-well fire-fighter, are on the scene and are attempting to snuff out the fire, preparatory to capping the well.

Point Coupee Parish Gets New Oil-Field Discovery

Discovery of another oil field, located in the Bayou Sherman area of Point Coupee Parish, apparently has been made by The Texas Co. at its 1 Wilbert, deep wildcat test in 34-6s-7e. The well, with casing perforated in sand just above 9,700 ft., flowed 146 bbl. of 38°-gravity oil in 24 hours through an X-30 choke with 1,500 psi. pressure on the tubing. Gas-oil ratio was 960 cu. ft. per barrel.

Location is approximately 2 miles north of the Sherburne field and about the same distance west of the Lottie field. Both of the latter fields also were discovered by The Texas Co.

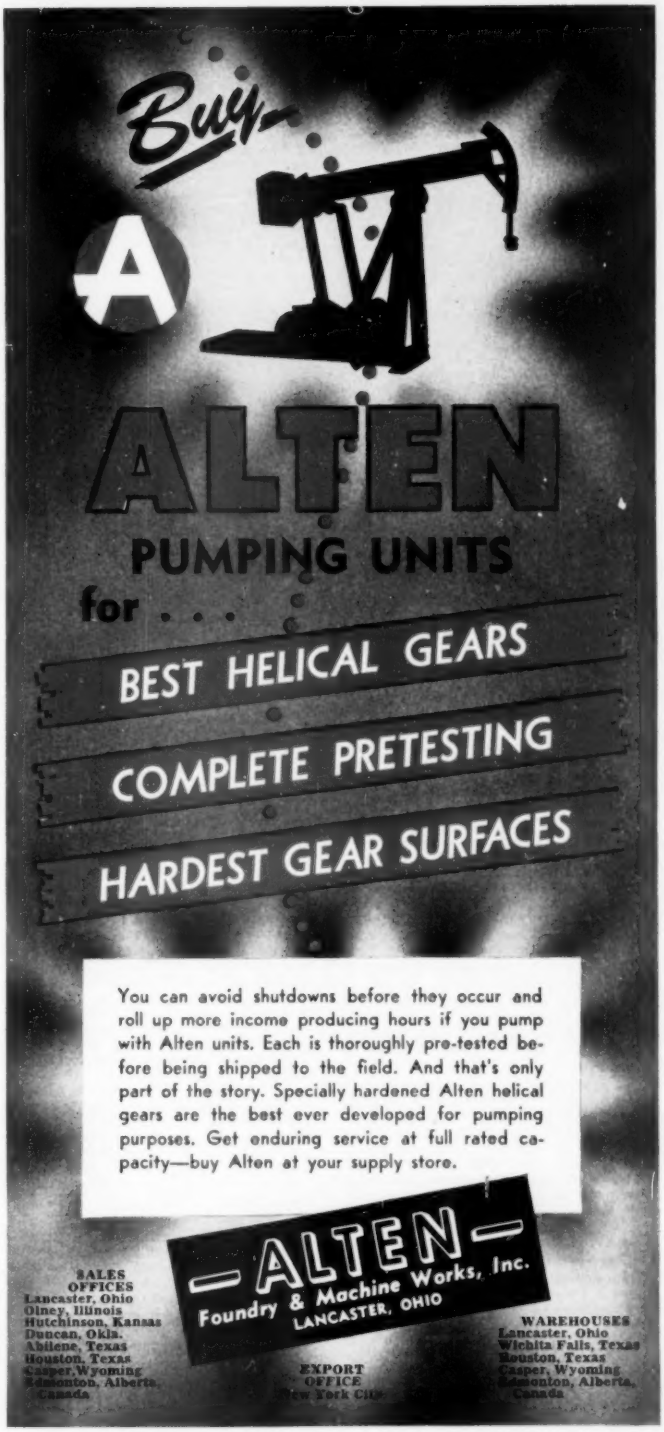
The new well had been drilled to a total depth of 11,095 ft. Casing was run to 9,700 ft. and hole plugged back.

NORTH LOUISIANA

New Pay Indicated at Clay Field in Lincoln

Clay field in southern Lincoln Parish, north central Louisiana, has a new indicated gas-condensate pay discovery at Southwest Gas Producing Co., Inc.'s 1 Sherrard, Section 10-17n-3w.

The well flowed an unestimated amount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of gas and condensate from open hole at 10,063-72 ft. in what is believed to be the upper Cotton Valley formation. Operator is fishing for the packer which was lost while pulling the test tool.

Clay field was opened last year by Southwest and Feazel's 1 Redwine, Section 11-17n-3w, producing gas-condensate from the Travis Peak sand perforations at 9,708-16 ft. The new pay discovery at 1 Sherrard is 5,350 ft. west of the field discovery well. The discovery well had Cotton Valley shows but not of commercial quantity.

In Bossier Parish another new gas-condensate discovery is preparing to test at Pan American 1 Hunt, Section 5-19n-13w. The indicated discovery is in the Bodcaw sand of the Cotton Valley. This test is located in the Willow Chute area of Bossier. The well flowed about 2,000 to 2,500 M.c.f. of gas and an estimated 15 to 20 bbl. of condensate per million while cleaning from perforations at 8,316-30 ft.

CANADA

New Devonian Discovery Noted at Ewing Lake

Another Devonian oil discovery has been assured by Canadian Gulf Oil Co. at a step-out venture in the Ewing Lake area of the Stettler region, 90 miles northeast of Calgary. This well, Gulf-C.P.R. 11 Lohr, LSD 11, 25-37-21w4, 1¼ miles northeast of Gulf's west Ewing Lake D3 reef oil discovery and 4 miles west of the company's South Stettler oil producers, found its oil in the D2 zone of Devonian.

Indications are that the well found approximately 35 ft. of D2 oil-bearing zone. Crew contacted D2 at 5,296 ft., or 2,530 ft. subsea. Initial drill-stem test in D2 porosity was from 5,315-25 ft. for 1 hour. Natural gas flowed in 19 minutes at rate too small to measure, and recovery was 360 ft. of heavy oil-cut mud. During test from 5,323-35 ft., packer did not seat properly, and 15 minutes recovery was 1,780 ft. of heavy oil and gas-cut drilling mud. Interval 5,335-45 ft. gave a gas blow in 10 minutes and 1 hour recovery of 570 ft. of clean 28.9°-gravity crude. Test from 5,345-55 ft. gave up 7 ft. of drilling mud, while test from 5,355-65 ft. yielded 1,170 ft. of salt water in 1 hour. The 11 Lohr is now at 5,430 ft., heading down in search of D3 Devonian reef.

A significant showing of light gravity crude oil has been found at a wildcat in the Barons area of southern Alberta, 30 miles northwest of Lethbridge and 70 miles southeast of Calgary.

The new find was made by Raymond I. Smith, American oil operator, at his driller on farmout lands acquired under agreement from Barons Oil, Ltd., of Calgary. The encouraging oil rise, although not deemed commercial at the present stage, came in the Cutbank section of the Basal Cretaceous, and is believed to be the first showing of light gravity crude in the Cutbank formation in Alberta. Only a few feet of section that is indicated to be equivalent to the Cutbank oil sand was found at the well.

The showing came at the R. I. Smith-Barons 1 Crown, LSD 8, 8-10-13-24w4, 2½ miles northwest of Viking sand oil production at Barons.

One-hour drill-stem test was run from 5,597 to 5,615 ft. and recovery consisted of 5 ft. of drilling mud and 80 ft. of dark brown gas-cut oil. Gravity of the oil is 30.8°.

The Smith well is currently bottomed at 5,634 ft. and crew is repairing rig, preliminary to taking hole down to test the Madison limestone.

EASTERN CANADA

New Brunswick.—Negotiations are in progress for the purchase by Stanwood Oil Corp. of Pennsylvania of the assets of New Brunswick Oilfields, Ltd., which controls the existing oil and gas production of the Stoney Creek field near Moncton, and has a 99-year renewable lease on gas and oil rights on 10,000 square miles of New Brunswick.

Stoney Creek field has more than 40 natural gas producers and 17 pumping oil wells. No drilling for oil has been done since 1945, but in 1949 five tests were drilled for gas, three being producers. Most of the wells have been producing for many years, and the output for lack of new production, has been steadily declining. Oil production declined from 21,372 bbl. in 1948 to slightly over 15,000 bbl. in 1951; and gas production in the same years from 420,352 M.c.f. to 261,579 M.c.f. Gas is marketed to the city of Moncton and the town of Hillsboro and the oil is processed locally for gasoline and heating and heavy fuel oil. Except for a few isolated tests, drilling has been pretty well restricted to Stoney Creek field in Albert and Westmoreland counties; and there are large areas and deeper horizons still untested in other parts of the province.

Ontario.—In Mono township, Dufferin County, Fred A. Davidson of Wingham, drilling for water on the Frank Little farm 9 miles west of Alliston, encountered a show of gas at around 250 ft. with 25 to 40 psi. The gas was in a potentially petroliferous dolomite formation.

In Norfolk County, a test drilled by Elmo Hoover of Aylmer on the W. Royden Cathers farm west of Port Burwell at 300 ft. encountered a gas flow estimated at 25,000 cu. ft. a day.

MICHIGAN

Richfield Development Receives Important Boost

The Richfield oil development program in West Branch pool, Ogemaw County, appeared to be assuming greater importance as a new well, close to the top of the old Dundee oil producing structure, and almost 2 miles east and south of the first three Richfield wells in the pool, logged a top Richfield pay, first top pay to be found, was acidized in this zone, and then was being deepened to the so-called zone 3 pay, from which the other three wells in the Richfield pool are being produced.

This new pay extension well is the Gallaher, English & Ehinger 1 Townsend, NE SE NW 19-22n-2e, just north of the West Branch city limits. Richfield top was logged at 3,900 ft. Pay showed at 3,901-09 ft. First pay in other wells starts to show from 8 to 9 ft. in the objective. Well carried 450 ft. of oil natural in 20 hours. After a semi-dump acid treatment with 2,500 gal., well swabbed and flowed 30 bbl. or more of net oil on initial test. Well was being deepened.

The new Concord Traverse oil field development in Concord Township, Jackson County, took on renewed interest as Allied Investments, Inc. was completing its 2 Hubbard, NE SE SE 35-3s-3w, as a better producer in this objective than the discovery well on the same lease. The 2 Hubbard is the diagonal northwest 20-acre offset to the discovery. Traverse lime at this new well was logged at 1,620 ft. Drilling was suspended one foot in the objective, at 1,621 ft. Well filled 1,400 ft. with oil in 2 hours and flowed natural for 20 minutes, producing 10 bbl. of oil before flow subsided. In all, well swabbed and flowed 100 bbl. of oil natural before it was acidized with 1,000 gal. After acid treatment, well kicked off and flowed as much as 20 bbl. of net oil an hour, but flowing rate gradually declined and well was estimated to be good for from 50 to 75 bbl. of oil a day. The 1 Hubbard discovery is pumping about 10 bbl. of oil and a like amount of water a day. The 2 Hubbard, 7 ft. higher structurally than the discovery, showed no water.

APPALACHIAN AREA

PENNSYLVANIA

Important Confirmation Wells Finaled in Elk Area

The past week in Pennsylvania saw the completion of two important confirmation wells in the Benezette Township, Elk County area.

Two miles northeast of the discovery well of the area, Keta Gas & Oil 1 Charleroi Mt. Club, the Delta Drilling Co. drilled in its 1 Sagamore Big Game Club as a good gasser in the Oriskany sandstone. Drill-stem test of the interval from 6,859 ft. to 6,892 ft. showed an open flow of 4,200,000 cu. ft. of gas. Pipe has been run and completion will be made this week. Oriskany was topped at 6,872 ft. (elev. 2,091).

Two and one-half miles northwest of the Sagamore well and ¾ mile southeast of recently completed 1 Woodring well, Mid-Atlantic completed 1 Thurby with an open flow of 9,000,000 cu. ft. and a well-head pressure of 4,000 psi. Oriskany top is 6,099 ft. (elev. 989) and gas was at 6,101 ft.

New York... In Van Etten Township, Chemung County, N. Y., New York State Natural's 1 Ed. Kesselring filled up with 5,000 ft. of salt water from depths of 11,118 ft. and 11,145 ft. in the upper Cambrian. This is the first reported indication of porosity in the upper Cambrian in the New York-Pennsylvania area and has revived interest in the possibilities of finding production in sub-Devonian formations. Operators will attempt to seal off salt water and drill deeper.

OHIO

Preston Oil Co. Hydrofraced its latest completion in Mt. Zion pool with good results. The 2 Otto B. Horn, Section 24, Jackson Township, Knox County, made a fair showing of oil in Clinton sand, found at 3,028-76 ft., which increased to 260 bbl. per day after treatment. In the same area the Preston 2 Glenn Norris, Section 24, having sand at 3,007-50 ft., made 32 bbl. in the first 24 hours after shot.

Hall and Williams 9 F. L. Fulmer, Section 28, Washington Township, Holmes County, logged the Berea sand at 575-751 ft. with a good showing of oil natural and 70 bbl. in 24 hours after shot. This is the second recent well finding a thick section of sand in what is probably a filled channel.

WEST VIRGINIA

In the Moorefield district of Hardy County, Baker & Harshbarger 1 Thomas Williams, wildcat, recorded the Clinton sand at 2,875 ft. and is drilling at 3,033 ft. The Oriskany sand was previously reported at 594 ft. Deep Rock Oil Corp. has completed 1 Bertha H. Thornbury et al. in Williamsburg district, Greenbrief County, at a depth of 7,490 ft. Cleaning-out operations are in progress at a depth of 6,515 ft.

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INDIANA

Aux Vases Sand Discovery Is Completed Natural

C. S. Higgins-Paco 1 Bolin, Gibson County wildcat, has been completed for a daily pumping potential of 205 bbl. of oil. Pay section in the Aux Vases sand was from 2,042-51 ft., total depth. The new producer is the discovery well of the North King pool.

In Pike County, C. E. O'Neal #3 Davis, SW NW NE 32-1n-8w, completed as an extension to the West Petersburg pool. Total depth was 1,485 ft., and pumping potential was 65 bbl. of oil a day from Benoist sand at 1,318-32 ft.

WILDCAT COMPLETIONS

SOUTHWEST TEXAS

Atascosa County: George W. Delker 1 McNutt, Natascosa Colony Farm Tract, Lot 20. Dry. TD 942 ft.

H. W. Slater et al 1 McKinney, Blk. 73, H & GN Sur., A-419. Dry. TD 3,722 ft.

Bastrop County: E. J. Aylward 1 Benner, Michael Green Sur. Dry. TD 585 ft.

Bexar County: Moody Monroe 1 Bexar County Farms, James W. Tinsley Sur., A-98. Dry. TD 905 ft.

Duval County: M. M. Miller & Sons 1-D Fee, Blk. 21, Ball Ranch Subd., Agua Poquita Grant. Dry. TD 5,400 ft.

Edwards County: Humble Oil & Refining Co. 1 Guthrie, James Huie Sur. 39. Dry. TD 4,140 ft.

Frio County: Howeth & Mason 2 Kemper, S. M. Moos Sur., A-1023. IPP 40 BOPD, 42°, open hole 3,726-41 ft. TD 3,741 ft. New field.

Gonzales County: Producers Corp. of Nevada and Texita Oil Co. 1 Wright, Samuel McCoy Sur., A-340. Dry. TD 2,161 ft.

Hidalgo County: Hassie Hunt Trust 1 Wright, Blk. 70, Valley Farms Subd., Santa Anita Grant. Dry. TD 8,017 ft.

McMullen County: Phillips Petroleum Co. 3 Mula, GWT & T Sur. 5, A-534. Dry. TD 6,205 ft.

Real County: Stanolind Oil & Gas Co. 1 Knippa, J. D. Boon Sur., A-72. Dry. TD 8,184 ft. in Ellenburger.

San Patricio County: F. William Carr 1-A Gaines, Blk. 32, Welder & Odem Subd. Dry. TD 8,315 ft.

LaGloria Corp. 1 Willis, Lot 1, Blk. 12, 1st Subd. to Taft Farm Lands. Dry. TD 6,725 ft.

Plymouth Oil Co. 1-I Welder, Toyah Irrigation Co. Sur. Dry. TD 8,106 ft.

Starr County: Sun Oil Co. 1 Simpson-State, Obey Bowers Sur. 284. Dry. TD 5,802 ft.

Webb County: South Texas Oil & Gas Co. 1 Bruni, Blk. 7, El Ranchito Pasture, Jose V. Borrego Grant. Shut down. TD 1,649 ft.

South Texas Oil & Gas Co. 1 Walker, Sec. 462, Blk. 11. Dry. TD 1,963 ft.

Zavala County: Shell Oil Co. 2 Plumly, GC & SF Sur. 3, A-829. IP 4,999 M.c.f. daily 32/64-in., casing perforations 2,220-97 ft. TD 3,726 ft. in Serpentine. New field.

TEXAS GULF COAST

Bee County: Seaboard Oil Co. of Delaware 1 Russell, J. P. Smith Sur., A-308. Dry. TD 7,152 ft.

Brazoria County: Carnes W. Weaver 2 Morris, James Johnson, Walker & Borden Sur. 32, A-77. Dry. TD 10,706 ft.

Calhoun County: Humble Oil & Refining Co. 1 State, Tract 73 in Matagorda Bay. IP 3,860 M.c.f. daily and 18 BOPD, ¼-in., 55.3°, casing perforations 8,570-90 ft. New field (South Sand Point).

Chambers County: Humble Oil & Refining Co. 1 Union National Bank of Houston, James Lawrence Sur., A-168 (East Cotton Lake area). Dry. TD 9,500 ft.

DeWitt County: Western Natural Gas Co. 1-X Atkinson, John McCrabb Sur., A-32. Dry. TD 8,524 ft.

Fayette County: Hamman Oil & Refining Co. 2 McCrorey, William Kuykendall ½ Lge. A-219. IPP 20.69 BOPD, 21°, open hole 1,930-39 ft., TD 1,939 ft. New pay in Elm Grove field.

Sutton Drilling Co. 1 Pavlica, M.de la Harza Sur. Dry. TD 2,345 ft.

Galveston County: M. L. Mayfield Co. 1 Weidemann, S. F. Austin Sur., A-4. Dry. TD 9,050 ft.

Jasper County: American Republics Corp. and Houston Oil Co. of Texas 2 Salvador Castillo, Salvador Castillo Lge., A-6. IP 19,000 M.c.f. daily, Yegua perforations 7-191-96 ft. TD 8,125 ft. New pay in Castillo field.

American Republics Corp. and Houston Oil Co. of Texas 3 Salvador Castillo, Salvador Castillo Lge., A-6. IP 5,600 M.c.f. daily, open flow, Yegua perforations 7,252½-54½ ft. TD 8,120 ft. New pay in Castillo field.

Jefferson County: Michel T. Halbouty 1 Marrs McLean fee, Pelham Humphries Sur. IP 128.2 BOPD, ⅛-in., 28.8°, Frio perforations 5,026-30 ft. TD 5,316 ft. New pay in Spindletop field.

John W. Mecom 1 Cartwright et al, D. Brown Sur., A-5. Dry. TD 8,677 ft.

Karnes County: Schimmel-Palmer 2 Trial, Don Erasmo Seguin Sur. Dry. TD 4,040 ft.

Liberty County: John W. Mecom and Freeport Sulphur Co. 1 Boyt, C. B. Barrow Sur., A-131. Dry. TD 7,648 ft.

Live Oak County: F. William Carr 1 George West estate, W. D. Hodges Sur. 230, A-648. IP 3,200 M.c.f. and 4 BC per M.M.c.f., open flow, casing perforations 7,348-58 ft. TD 8,258 ft. New field (Peeler).

Carter & Carter 1 Thurmond, W. H. Hall Sur. IP 32,500 M.c.f. and 29 BOPD, open flow, casing perforations 8,322-28 ft. TD 8,603 ft. Extends Karon field.

Kirkwood & Morgan, Inc., 1 Booth et al, M. B. Kivlin Sur., A-21. IP 83.76 BOPD, 10-64-in., 25.5°, casing perforations 3,750-54 ft. TD 4,600 ft. New field.

Refugio County: Ohio Oil Co. 2 Bauer et al, George W. Main Sur., A-216. Dry. TD 10,311 ft.

Sam E. Wilson, Jr., 2-F Jamie Hynes, John Malone Sur., IP 168.36 BOPD, 11/64-in., 34°, Tom O'Connor sand 5,940-48 ft. TD 6,884 ft. New field (Hynes Ranch).

Victoria County: Second M. E. Andrews, Ltd., et al 2 Elmer Knolle, T & NO Sur., 359. Dry. TD 4,718 ft.

Ralph Lowe and Industrial Co. of Texas 1 Terrell, Peter Teal Sur., A-112. Dry. TD 5,395 ft.

EAST TEXAS

Anderson County: The Texas Co. 1 A. Petri, Wm. Sanson Sur., A-715. Dry. TD 4,939 ft.

Cherokee County: L. A. Grelling 1 O. O. Batton, J. M. Doherty Sur., A-485. Dry. TD 5,087 ft.

Falls County: L. M. Bailey 1 J. H. Browley, F. McGary Sur. Dry. TD 2,226 ft. in Edwards lime.

Houston County: Carter-Jones Drilling Co. 1 G. L. Richards, John L. Riviere Sur., A-49. Dry. TD 6,019 ft.

Hunt County: B. B. Banner 1 Maud Burnett, C. A. Warfield Sur. Dry. TD 3,065 ft.

Kaufman County: Thos. D. Humphrey & Sons 1 Dora Haney, Timothy Devore Sur. Dry. TD 4,150 ft.

Limestone County: Byrd Frost and Byrd Oil Corp. 1 A. P. Maddox, P. Varela Sur., A-30. Dry. TD 5,800 ft.

Navarro County: Coffield & Guthrie, Inc. 1 Bailey, J. Bragg Sur. Dry. TD 1,000 ft.

Pryor Dillard 1 J. T. and J. B. Fortson, David McCandless Sur. Dry. TD 1,312 ft.

*Robertson County: Union Producing Co. 1 Gibson, Geo. Robertson Sur., A-38. IP 5,600 M.c.f. gas, open flow, Glen Rose 6,140-61 ft. TD 8,053 ft.

TEXAS PANHANDLE

Hutchinson County: Northern Natural Gas Co. 1 Ray C. Moore, 67-R-BS&F. Dry. TD 7,196 ft., elev. 3,203 ft., Marmaton 6,250 ft., Oolitic lime 6,262 ft.

WEST CENTRAL TEXAS

Brown County: Johnson & Owen 1 G. T. Butler, John McLoin Sur. Dry. TD 1,361 ft.

Callahan County: Johnson & Warren 1 R. B. Taylor, 320-5-SPRR. Dry. TD 1,830 ft.

Magnolia Petroleum Co. 1 Josie Brown, Sec. 253, M. Potter Sur. Dry. TD 1,034 ft.

*Woodson Oil Co. 1 N. M. George, Sec. 69, BOH Sur. IP not gaged, gas sand 579-80 ft. TD 580 ft.

Coleman County: Cree Oil & Exploration Co. 2 Sealy & Smith Foundation, Blk. 2, GH&H Sur. Dry. TD 3,039 ft., elev. 1,791 ft., Gardner 2,850 ft.

Harold H. Hamilton 2 J. A. Baucom, David A. Murdock Sur. 738, Blk. 19. Dry. TD 2,572 ft.

*W. T. Waggoner Estate 1 Cresswell, 80-2-GH&H. IP 53 BO 3 hr., 20/64-in., 42°, Gardner sand 3,331 ft. TD 3,501 ft.

*D. H. Wigner et al 4 Oscar Gould, Sec. 739, A. Quigley Sur. IP 88.6 BOPD, 16/64-in., 44°, pay 2,090-2,103 ft. TD 2,151 ft.

Eastland County: Sells Petroleum Co. and Ace Oil Co. 1 Lige Tate, Sec. 796, Stanley Lackerman Sur. Dry. TD 2,407 ft.

*Haskell County: Continental Oil Co. 1 W. H. Buckner, Sec. 41, Wise CSL. IP 213 BOPD, 26/64-in., 38°, conglomerate 5,784-90 ft. TD 5,855 ft.

Robinson-Puckett, Inc., 1 Mrs. Lois Scruggs, 3-1-MEP&P. Dry. TD 2,605 ft.

*Jones County: Great Lakes Carbon Corp. 1 J. H. Benton, Sec. 4, D&DA Sur. IPP 85 BOPD, 39°, pay 2,070 ft. TD 2,080 ft.

Great Lakes Carbon 1 Wilson Goree, Sec. 14, D&DA. IPP 78 BOPD, pay 2,093 ft. TD 3,606 ft.

Andrew M. Howsley et al 1 J. A. Carnes, 36-1-BBB&C. Dry. TD 2,672 ft.

*Refrigerated Productions, Inc., 1 D. F. Bond, Sec. 204, J. W. McKissick Sur. IP 192 BOPD, 16/64-in., Strawn sand 4,550 ft., elev. 1,720 ft. TD 4,604 ft.

Nolan County: J. C. Barnes 1 Aycock, 58-21-T&P. Dry. TD 6,257 ft., elev. 2,129 ft., Caddo 6,094 ft., Ellenburger 6,220 ft.

Shackelford County: West Central Drilling Co. 1 J. H. Nail Estate 19, Sec. 19, ETRR Sur. Dry. TD 1,004 ft.

Stephens County: Oil & Gas Incomes, Inc. 1 C. J. Jones, Sec. 1760, TE&L Sur. Dry. TD 3,224 ft.

F. Kirk Johnson 3 C. K. West, Sec. 1,096, TE&L Sur. Dry. TD 4,085 ft.

Stonewall County: Edgar Davis Drilling Co. 1 Arthur S. Brinkley, 4-9-AB&M. Dry. TD 6,365 ft.

C. L. Norsworthy, Jr., 1 C. A. Brown, 31-D-H&TC. Dry. TD 6,517 ft., elev. 1,690 ft., Mississippian 6,174 ft., Ellenburger 6,376 ft.

Southern Minerals Corp. et al 1 Lloyd H. Smith, Eli Chandler Sur. Dry. TD 6,336

WILDCAT COMPLETIONS

ft., elev. 1,687 ft., Mississippian 6,079 ft., Ellenburger 6,242 ft.

*Taylor County: R. G. McMurrey Trust 1 A. C. McMillon, G. Hancock Sur. IP 170 BOPD, 16/64-in., 39°, pay 3,955-58 ft. TD 3,972 ft.

NORTH TEXAS

Archer County: Archer Drilling & Production Co. 2 Walsh, TE&L Sur. 2416. Dry. TD 1,368 ft.

*Chapman Oil Co. 1-A Wilson Properties, Lot 1, Blk. 94, ATNCL. IPF 65 BOPD, 39°, pay 1,522 ft. TD 1,524 ft.

*Cox Drilling Co. 3-B Wilson, H&TC Sur., A-1278. IPP 46 BOPD, 41°, pay 3,557-61 ft. TD 5,294 ft.

S. F. Hutcheson 3 Langford Investment Co., Blk. 148, Harris Subd. Dry. TD 1,187 ft.

T. O. Peery 1 J. S. Walsh, Blk. 2416, A-593, TE&L Sur. Dry. TD 1,401 ft.

Baylor County: Alvin Shambeck 1 H. S. Koether, 2462-A480-TE&L. Dry. TD 1,686 ft.

Clay County: L. T. Burns 1 A. Grinke, Blk. 25, Halsell Subd. 1. Dry. TD 6,029 ft.

Hale Bros. and Critchell 1 Mamie Sheer, 51-A308-Orange CSL. Dry. TD 6,224 ft.

Cooke County: Snuggs & Swick 1 R. J. Timmis, M. O. Kouskie Sur. Dry. TD 4,152 ft.

*Grayson County: Howell, Holloway & Howell 1 S. F. Earl, J. Browning Sur., A-97. IPP 19 BOPD, 23.5°, Ellenburger 5,213 ft., elev. 806 ft. TD 5,280 ft. New pool.

*Standard Oil Co. of Texas 1 V. Clinton, Frances Atchison Sur., A-21. IPP 48.6 BOPD, 34°, pay 7,612-26 ft. TD 7,745 ft.

Jack County: Glenn W. Cooper 2 D. D. Gillespie, Wm. Berryman Sur., A-40. Dry. TD 540 ft.

Knox County: Humble Oil & Refining Co. 1-C McFaddin, 104-13-H&TC. Dry. TD 6,315 ft.

Hunt Oil Co. 1 B. B. Burnett, 68-C-H&TC. Dry. TD 6,332 ft.

R. W. McDonnell 1 L. R. Burnison, 123-45-H&TC. Dry. TD 5,000 ft.

Montague County: G. E. Kadane & Sons 1 L. R. Gist, F. Robertson Sur. Dry. TD 2,465 ft.

W. B. Omohundro 1-C Seay, 30-4-H&TC. Dry. TD 5,872 ft.

*Standard Oil Co. of Texas 1 J. T. Langford, W. C. Robertson Sur., A-1186. IP 174 BOPD, 12/64-in., 40°, pay 5,814-28 ft. TD 5,870 ft.

Star Oil Co. 1 J. P. Clingingsmith, Blk. 173, J. Olaharri Sur. Dry. TD 6,322 ft.

Wilbarger County: Dublin-Kiel 1-B Waggoner, 3-5-H&TC. Dry. TD 2,501 ft.

R. C. Lipscomb 1 Clara Simmonds, 15-15-H&TC. Dry. TD 5,181 ft.

John & Pat O'Neil 1-U Waggoner, 27-4-H&TC. Dry. TD 2,448 ft.

R. Clay Underwood 1 Waggoner, 7-17-H&TC. Dry. TD 2,005 ft.

Frank Wood 1 Waggoner-Shanor, 47-2-H&TC. Dry. TD 2,452 ft.

Wise County: Tom B. Medders 1-A Mrs. Forrest M. Jones, J. H. Howell Sur., A-934. Dry. TD 3,623 ft.

Young County: Joe K. Bailey 1-S Moore, Ross Sur. Dry. TD 611 ft.

Erle F. Gunby 1 Woolfolk, Blk. 13, TE&L Sur. Dry. TD 3,007 ft.

Franklin Love & Co. 1 K. A. Caudill, Pedro Quero Sur., A-238. Dry. TD 4,005 ft.

WEST TEXAS

*Andrews County: Magnolia Petroleum Co. 1-BA Fasken, 21-40-T2N-T&P. IP 114 BOPD, 14/64-in., 50°, Pennsylvanian 12,818-46 ft. TD 13,560 ft., elev. 2,927 ft. New pool.

Cottle County: Gulf Oil Corp. 1 D. C. Shamburger, Sec. 5, F. P. Knott Sur. Dry. TD 7,051 ft., elev. 1,760 ft., reef 4,440 ft.

Culberson County: Ralph Lowe 1-B State, 8-45-PSL. Dry. TD 2,665 ft.

*Dickens County: Skelly Oil Co. 1 G. F. Smith, 162-1-H&GN, IPP 113 BOPD, 36°, Tannehill sand 4,414-36 ft. TD 4,535 ft., top Tannehill 4,408 ft., elev. 2,238 ft. New pool.

*Gaines County: Anderson-Prichard Oil Corp. 2-A Parmer, 21-317-Parmer CSL. IPP 4.5 BOPD, pay 5,150-5,210 ft., TD 12,805 ft., elev. 3,064 ft., Pennsylvanian 10,940 ft.

Glasscock County: Cities Service Oil Co. 1 H. G. Cross, 17-35-T&P. Dry. TD 11,195 ft., elev. 2,620 ft., Pennsylvanian 9,910 ft., Silurian 10,520 ft., Ellenburger 11,080 ft.

King County: C. L. Norsworthy, Jr. 1 Pitchfork, Sec. 2, MEP&P. Dry. TD 5,500 ft., elev. 2,028 ft., Pennsylvanian 3,709 ft., reef 4,925 ft.

Loving County: Phillips Petroleum Co. 1-A Dodson, 2-55-T&P. Dry. TD 4,017 ft.

Pecos County: Childress Royalty Co. 1 Atlantic Refining Co., 106-OW-GC&SF. Dry. TD 3,148 ft.

*G. D. Putman & Co. 1 Hart, 31-11-H&GN. IP 264 BOPD, 3/8-in., 34°, pay 2,415 ft. TD 4,754 ft.

Presidio County: Gulf Oil Corp. 1 Mitchell Bros., 40-1-TWNG. Dry. TD 15,996 ft., elev. 5,338 ft., Strawn 11,890 ft., Mississippian 12,625 ft., Devonian 13,435 ft., upper Ordovician 13,820 ft., middle Ordovician 14,260 ft., lower Ordovician 15,230 ft.

Reagan County: Cabot Carbon Corp. et al 1-B University, 18-11-University lands. Dry. TD 10,260 ft., elev. 2,626 ft., Ellenburger 9,440 ft.

Runnels County: John J. Eisner 1 J. M. Thompson, Sec. 114, A. C. Kelsey Sur. Dry. TD 3,784 ft., Caddo 3,686 ft.

*Schleicher County: Carter & Carter 2 Webster, 1-8-TW&NG. IP 50 BOPD, 50°, 9,000 M.c.f. gas, Ellenburger 4,590 ft. TD 4,825 ft.

Sinclair Oil & Gas Co. 1 Margaret Thompson, 29-A-HE&WT. Dry. TD 6,771 ft., elev. 2,390 ft., reef 6,368 ft., Ellenburger 6,725 ft.

Sutton County: Byrd Oil Co. 1 Vanderstucker, 67-7-TN&G. Dry. TD 4,279 ft., elev. 2,225 ft., Strawn 4,197 ft.

Tom Green County: Rowan Oil Co. 1-A E. H. Jones, 888-1534-Joseph Jung Sur. Dry. TD 6,515 ft., elev. 1,958 ft., Ellenburger 6,276 ft.

Upton County: Oliver & Kotyza 1-B Kincaid, 18-1-MK&T. Dry. TD 2,235 ft.

SOUTHEAST NEW MEXICO

Eddy County: DeKalb Agricultural Association 1-21 C. P. Pardue "Z," 21-24s-28e. Dry. TD 2,665 ft.

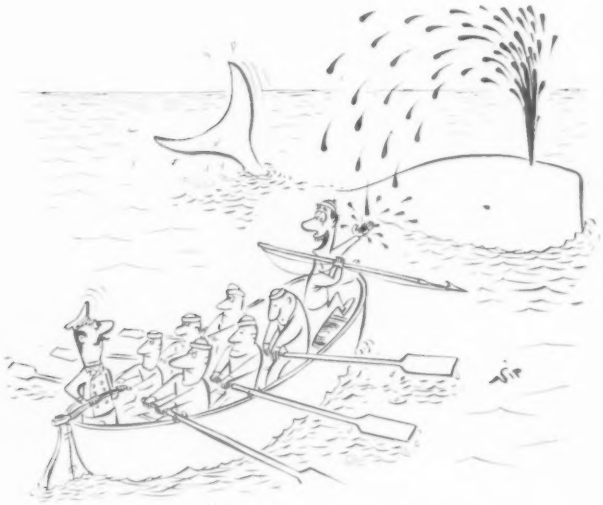
Lea County: George P. Livermore 1-A State, 1-18s-33e. Dry. TD 5,480 ft., elev. 4,101 ft., San Andres 4,915 ft.

ILLINOIS

Clinton County: Sun Oil Co. 1 Kasten, SW NE NW 29-1n-3w. Dry. TD 2,557 ft., Devonian 2,453 ft.

Macoupin County: C. Jenson 1 Johnson, SW NW SE 7-7n-7w. Dry. TD 540 ft.

Wayne County: H. D. Atha 1 Hitz, SW SE SE 19-1s-9e. Dry. TD 3,380 ft., McClosky 3,358 ft.



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INDIANA

Dubois County: R. C. Tilton 1 Prior, SW SE NW 1-3s-6w. Dry. TD 1,192 ft., McClosky 1,093 ft.

Gibson County: D. Lambert 1 Landers, SW SW NW 10-2s-10w. Dry. TD 2,032 ft., St. Genevieve 1,945 ft.

*C. S. Higgins-Paco 1 J. Bolin, NW SE NE 19-2S-10w. TD 2,051 ft., IPP 205 BOPD, Aux Vases sand 2,042-51 ft., TD 2,051 ft. Discovery of North King pool.

Perry County: R. Jarboe 1 Winter, SW NW NE 9-6s-3w. Dry. TD 695 ft.

Vigo County: C. B. Mansfield 1 Loyd, NW NW SE 23-11n-10w. Dry. TD 2,169 ft., Salem 2,169 ft.

KENTUCKY

Daviess County: Basin Drilling Co. 1 Cook, SW NW NE 23-Q-27. Dry. TD 1,975 ft., McClosky 1,899 ft.

J. C. Miller 2 Poole, NE SW NW 5-N-27. Dry. TD 2,306 ft., McClosky 2,302 ft.

Henderson County: Hupp-Hoffman et al 1 Watkins, NE SE SE 22-P-24. Dry. TD 2,518 ft.

Logan County: F. S. Stephenson 1 W. Bailey, SE SE SE 3-F-34. Dry. TD 1,859 ft., Ordovician 1,836 ft.

MICHIGAN

Missaukee County: Mason E. Holloway 1 Nelson heirs, SW NE NE 10-23n-6w. Dry. TD 4,810 ft. in Richfield.

Montcalm County: Socony-Vacuum Oil Co., Inc. 1 Hansen, NE NW NE 27-12n-6w. Dry. TD 3,531 ft. in Dundee.

Osceola County: Associated Drillers & Producers, Inc. 1 Evans et al, NW NE NW 8-17n-8w. Dry. TD 3,865 ft. in Dundee-Reed City zones.

OHIO

Noble County: B. H. Putnam et al 1 Carlos Foster, Sec. 23, Sharon Township. Dry. TD 4,096 ft. in Oriskany sand.

ALABAMA

Clark County: Humble Oil & Refining Co. 1 Gilmore et al, C SE NE 33-7n-4e. Dry. TD 4,957 ft.

Escambia County: Gulf Refining Co. and Commonwealth Oil Co. and others 1 Steward et al, C NE SE 31-2n-9e. Dry. TD 6,402 ft. in lower Cretaceous. Elev. 232 ft., Wilcox 1,490 ft., Eutaw sand 5,143 ft., Marine Tuscaloosa 5,670 ft., Massive 5,920 ft., Lower Cretaceous 6,130 ft.

I. P. and Fred LaRue 1 Adkinson, C NW NW 30-1n-11e. Dry. TD 6,291 ft. in lower Cretaceous. Elev. 244 ft., Eutaw 4,755 ft., Massive 5,909 ft., lower Cretaceous 6,114 ft.

MISSISSIPPI

Adams County: John S. Callon and F. H. Shortridge 1 Minter, SE SE SE 5-5n-1w. Dry. TD 7,009 ft. Elev. 299 ft., Wilcox 4,622 ft., base Baker shale 6,445 ft., Minter 6,709 ft.

Jasper County: Kemp Drilling Co. and others 1 Bufkin, C E½ SE SE 26-1n-10e. Dry. TD 7,676 ft. in lower Tuscaloosa. Elev. 386 ft., Wilcox 1,728 ft., Midway 4,255 ft., Selma 4,817 ft., Eutaw 6,068 ft., Tuscaloosa 6,592 ft., Marine Tuscaloosa 7,452 ft.

Jefferson County: Lyle Cashion Co. and others 1 Gordon-Stowers-Armstrong unit. IP 100 BOPD, 13/64-in., 40°, Artman sand 5,326-28 ft. (casing perforations). TD 6,051 ft. Elev. 129 ft., Wilcox 3,650 ft., base Big Shale 5,006 ft., Artman 5,325 ft. New field (Idlewilde).

WILDCAT COMPLETIONS

Madison County: Southeastern Drilling Co. 1 Parkinson, C SE SW 23-9n-1w. Dry. TD 11,717 ft. Elev. 258 ft., Gas Rock 4,400 ft., Eagle Ford 6,027 ft., Tuscaloosa 6,709 ft., Marine Tuscaloosa 7,078 ft., lower Cretaceous 7,535 ft., Hosston 10,400 ft.

Wayne County: American Liberty Oil Co. 1 U.S.A., NE NW NW 7-6n-8w. Dry. TD 8,445 ft. in lower Cretaceous. Elev. 313 ft., Wilcox 2,006 ft., Midway 4,750 ft., Eutaw 6,486 ft. (cut fault at 6,021 ft.), Tuscaloosa 6,820 ft., lower Cretaceous 8,321 ft.

Wilkinson County: Durbin Bon & Co. and B. Serio 1 King, NW SE SW SW 28-2n-3w. Dry. TD 8,510 ft. Elev. 290 ft., Wilcox 6,205 ft., base Big Shale 7,531 ft., base Baker shale 8,014 ft.

SOUTH LOUISIANA

Acadia Parish: Sunray Oil Corp. 1 Daly, 44-8s-2e. IP 80 BCPD and 1,740 M.c.f. daily, 10/64-in., 56°, casing perforation 10,812-18 ft. and 10,826-38 ft. TD 10,905 ft. New pay in Northwest Branch field.

Assumption Parish: Arkansas Fuel Oil Co. 1 Brownell-Kidd, 27-12s-12e. Dry. TD 12,518 ft.

Iberia Parish: Shell Oil Co. 1 Weeks-Gall, 12-14s-6e. IP 320 BOPD and 8,281 M.c.f. daily, 17/64-in., 39.2°, sand 17,038-122 ft. TD 17,183 ft. New pay in Weeks Island field. World's deepest oil producer.

Plaquemines Parish: Gulf Refining Co. 1 State, Lease 1494 in Breton Sound, East Black Bay area. Dry. TD 8,750 ft.

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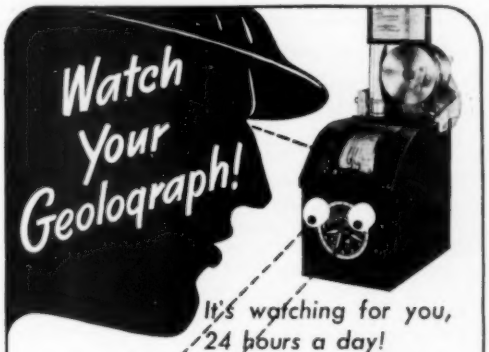

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Casper, Wyo.—Glendive, Mont.—Sterling, Colo.
Calgary and Edmonton, Alberta, Canada
Regina, Saskatchewan, Canada

WILDCAT COMPLETIONS

Kerr-McGee Oil Industries, Inc., 1 State, Lease 1998, Block 21, Breton Sound. Dry. TD 3,250 ft. (Core test).
Kerr-McGee Oil Industries, Inc., 1 State, Lease 1999, Breton Sound. Dry. TD 3,000 ft. (Core test).
Kerr-McGee Oil Industries, Inc., 2 State, Lease 1999, Breton Sound. Dry. TD 3,250 ft. (Core test).
Kerr-McGee Oil Industries, Inc., 4 State, Lease 1999, Breton Sound. Dry. TD 3,250 ft. (Core test).
Kerr-McGee Oil Industries, Inc., 1 State, Lease 2000, Breton Sound. Dry. TD 3,000 ft. (Core test).
Kerr-McGee Oil Industries, Inc., 2 State, Lease 2000, Breton Sound. Dry. TD 3,250 ft. (Core test).
St. Landry Parish: Humble Oil & Refining Co. 1-B Society of Roman Catholic Church, 120-4s-7e. Dry. TD 10,595 ft.
St. Mary Parish: Atlantic Refining Co. 1 Suphemie Smith, 31-13s-9e. Dry. TD 8,503 ft.

NORTH LOUISIANA

Bossier Parish: John R. Kennedy 1 Atlantic-Crystal, 50 ft. E of C NW NW NE 20-20n-13w. Dry. TD 1,136 ft.
Webster Parish: Pan Am Southern Corp. 1 Browning, C SW SW 28-23n-10w. Dry. TD 7,115 ft.

ARKANSAS

Columbia County: McAlester Fuel Co. 2 Foster-Grayson Lumber Co. "A," 10-19s-20w. Dry. TD 5,293 ft.
Ouachita County: Davis & Pace 1 Myatt, C SW SW NE 17-15s-17w. Dry. TD 4,005 ft.
* Union County: Don D. Montgomery et al 1 Brasher, C SW NE 14-17s-16w. IPF 120 BOPD, Cotton Valley 4,941-50 ft. TD 6,819 ft. (Opens East Lisbon pool.)

OKLAHOMA

Beaver County: Huber-Sohio et al 1 Sharp "A," C NE NW 18-6n-22eCM. Dry. TD 6,400 ft. Chester 6,254 ft.
Garfield County: Olson Oil Co. 1 Caudle, SE SE SE 27-20n-3w. Dry. TD 6,062 ft.
*Garvin County: Cities Service 1 Alcorn, C NW SE 2-3n-4w. IPF 50 BOPD, Hart 8,480-8,549 ft., 173 BOPD, Springer 9,178-9,260 ft. TD 9,344 ft. (Hart discovery in unnamed pool).
Ashland Oil & Refining Co. 1 Howerton, C NW NE 22-2n-3w. Dry. TD 8,228 ft.
Harmon County: Giddens & Shriver 1 Yarbough, C NE NW 5-1n-24w. Dry. TD 5,217 ft.
Kay County: Ben J. Taylor and Duncan 1 Wentz Est., SE SE SW 33-28n-2e. Dry. TD 3,987 ft.
Kingfisher County: Falcon-Seaboard Drilling Co. 1 Mitchell, C NW NE 23-19n-7w. Dry. TD 5,845 ft. Upper-lower Layton 5,730 ft.
*Lincoln County: Charles H. Mee 1 Harrold, SW NW SE 26-14n-3e. IPF 12 BOPD, lower Skinner 4,351-58 ft., 9,664 M.c.f. of gas. TD 4,358 ft. (New pay at NW Midlothian).
Earl E. Barnes 1-A Meadows, SE SE NE 25-15n-4e. Dry. TD 4,052 ft.
Altus Drilling Co. 1 Emma Clauson, NW NW SW 22-16n-2e. Dry. TD 5,241 ft.
McCurtain County: Tague-Harris-Brown 1 Paschal, N½ SE SE 13-7s-21e. Dry. TD 320 ft.
R. George 1 Dameron, SE NW NW NW 16-8s-23e. Dry. TD 1,598 ft.
*Noble County: T. M. Anderson and Wolfe Drilling Co. 1 Rush, SW NE SW 30-24n-2w. IPF 80 BOPD, Layton 3,956-67 ft. TD 4,982 ft. (New pool).
Oklahoma County: Glen H. McCarthy 1 Roberts, SW NW NW 17-14n-1e. Dry. TD 4,475 ft.
Harper-Turner 1 Hogan, SE SE SE 8-14n-3w. Dry. TD 6,640 ft.
Pawnee County: Howden Petroleum Corp. 1 Miller, NE SW SW 20-22n-6e. Dry. TD 3,251 ft.
Payne County: Seneca Oil Co. and Atmar Drilling Co. 1 Minnich, NW NE SW 33-18n-1e. Dry. TD 5,375 ft.
Pontotoc County: Patrick A. Doheny 1 Busby "B," SE NW SE 12-4n-8e. Dry. TD 1,402 ft.
*Seminole County: Austin Dunham et al 1 Bates, NE NW SW 24-6n-5e. IPF 75 BOPD, middle Thurman 2,655-75 ft. TD 2,750 ft. (New pool).
Texas County: The Texas Co. 1 Goosen, C NW NW 29-4n-19eCM. Dry. TD 6,800 ft. Chester 6,660 ft.

KANSAS

Barton County: Braden Drilling Co. 1 Eveleigh, SW SW SE 5-18s-12w. Dry. TD 3,412 ft.
Northern Pump 1 Hampel, NW NW NW 34-17s-15w. Dry. TD 3,557 ft.
Butler County: K. T. Wiedemann 1 Lucas, NW NW NE 16-27s-7e. Dry. TD 2,696 ft.
*Clark County: Peters-Writer-Christensen 1 Theis, SW SW NE 23-34s-25w. IP 5,500 M.c.f. of gas daily, Chester 5,670-5,756 ft. TD 6,113 ft.
Cowley County: Glickman 1 Albright, SE SW NE 2-34s-5e. Dry. TD 3,141 ft.

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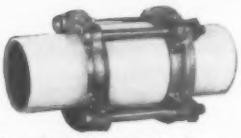

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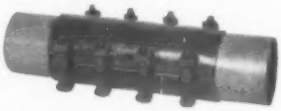

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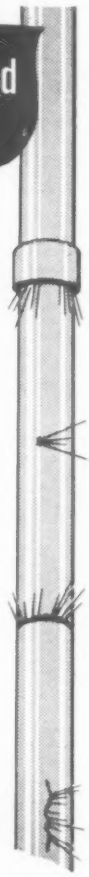

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Ellis County: Lion Oil Co. 1 Werth, NE NE NW 2-13s-20w. Dry. TD 3,935 ft.

Finney County: Trans-Era-Palmer 1 Doyle, NE NE SW 27-22s-30w. Dry. TD 4,856 ft.

Harvey County: J. P. Gaty 1 Golden, NE SE SE 28-24s-2e. Dry. TD 3,270 ft.

Jewell County: National Associated Petroleum 1 Roe, NE NE NE 19-1s-7w. Dry. TD 4,120 ft.

Mitchell County: National Associated 1 Theissen, SW SW SE 15-6s-9w. Dry. TD 3,960 ft.

*Morton County: Cities Service Oil Co. 1 Hart "A," SW SW NE 22-33s-43w. IP 14,000 M.c.f. of gas daily, Topeka 2,906-3,050 ft. TD 3,425 ft.

Phillips County: Murfin 1 Armstrong, CEL NE SE 35-4s-18w. Dry. TD 3,457 ft.

Rice County: T. H. Mastin 1 Snider, SE SE SE 4-21s-10w. Dry. TD 3,402 ft.

*Rush County: Morrison 1 Reichel, SW NW NE 23-17s-17w. IP 29,000 M.c.f. of gas daily, Lansing-Kansas City 3,330-48 ft., 3,393-3,411, 3,419-29 ft. TD 3,478 ft. (Opens Reichel pool).

Trego County: Amerada Petroleum Corp. 1 Seena, SE SE NE 31-11s-22w. Dry. TD 4,118 ft.

H. Gore 1 Braumer, NW NW NW 14-15s-21w. Dry. TD 4,255 ft.

NEBRASKA

Cheyenne County: Ohio Oil Co. 1 Sharman, E½ W½ SW 9-14n-48w. Dry. TD 4,710 ft. base "J" sand 4,690 ft.

CALIFORNIA

Fresno County: Standard Oil Co. 51-22F Guijarral Service Co., 22-20s-16e. Dry. TD 10,421 ft.

Kern County: Standard Oil Co. 2-73 Karpe, 34-29s-26e. Dry. TD 9,040 ft.

Oceanic Oil Co. 1 Illinois Crude, 22-32s-23e. Dry. TD 4,934 ft.

Royalty Service Corp., Ltd. 1 Bank, 18-27s-27e. Dry. TD 2,508 ft.

* Union Oil Co. 46-24 Reserve-Kerr, NE SW 24-11n-19w. IP 213 BOPD, 24/64-in., 33.5°, perforations at 6,912-19 in Tecuya sand (Oligocene). TD 7,076 ft. (New field discovery in Tejon Ranch area.)

* Los Angeles County: Hathaway Co. 1 Woodward, SE NE 11-3s-11w. IP 200 BOPD, 12/64-in., 35.6°, perforations 8,486-8,686 ft. TD 8,792 ft. (New Miocene sand pool discovery in Leffingwell area.)

Sunray Oil Corp. 54-14 Rydell-Haas Comm., 14-2n-16w. Dry. TD 6,268 ft.

Intex Oil Co. 1 Toon, 2-2n-15w. Dry. TD 4,553 ft.

Madera County: Tide Water Associated Oil Co. 1-29 Roduner, 29-10s-14e. Dry. TD 3,150 ft. in Kreyenhagen.

Merced County: Standard Oil Co. 51 Redfern, 28-11s-12e. Dry. TD 13,005 ft.

Sutter County: Richfield Oil Corp. 1 Capco A, 18-15n-2e. Dry. TD 2,330 ft.

Yolo County: Standard Oil Co. 1 Cordelia-Walker Estate, 10-11n-1e. Dry. TD 6,258 ft.

MONTANA

Dawson County: Dakota-Williston Oil Corp. 1 Mutzenberger, E½ NE NE 2-16n-53e. Dry. TD 9,472 ft. Devonian 9,275 ft.

WYOMING

Weston County: Black Hills Drilling Co. 1 Aminetto, C NE NW 1-43n-62w. Dry. TD 3,570 ft. Lakota 3,440 ft.

IDAHO

Teton County: Phillips Petroleum Co. 1 Unit, C SE SW 28-5n-44e. Dry. TD 12,720 ft. Mississippian 12,676 ft.

WILDCAT COMPLETIONS

UTAH

Sevier County: K. D. Owen 1 Government, NE SW NE 23-22s-5e. Dry. TD 3,670 ft. Curtis 3,560 ft.

COLORADO

Washington County: Herndon Drilling Co. 1 Wenninger, NE SE NE 14-2s-53w. Dry. TD 4,915 ft. "J" sand 4,677 ft.

Weld County: C. G. Glasscock 1 Merrill, C SE NE 26-9n-59w. Dry. TD 6,792 ft. Skull Creek 6,794 ft.

SASKATCHEWAN

* Tide Water 1 Loomis Crown, LSD 5, 1-3-21w3. Jurassic sand oil well. TD 4,823 ft.

ALBERTA

* Gulf-CPR 3 Dennis, LSD 3, 35-42-19w4, basal quartz gas well. TD 5,800 ft.

Driver-Rex 1 Arrow, LSD 4, 16-50-4w4. Colony sand heavy crude oil well. TD 2,145 ft.

* Mill City-Sharples-Kroy-Sweetgrass 1 Kessler, LSD 13, 27-38-8w4. Viking sand gas well. TD 2,380 ft.

Prado 6-26 H. B. Chauvin, LSD 6, 26-43-1w4. Dry. TD 2,413 ft.

Phil "C" 1, LSD 8, 23-90-5w6. Dry. TD 4,060 ft.

Royal American & Associates 1, LSD 8, 26-63-6w5. Dry. TD 4,503 ft.

Texaco 1-A Grassy Lake, LSD 12, 10-10-13w4. Dry. TD 3,121 ft.

Superior et al 1 Solomon Creek, LSD 6, 17-51-27w5. Dry. TD 11,321 ft.

R. I. Smith et al 1 Crown, LSD 11, 36-48-12w4. Dry. TD 3,502 ft.

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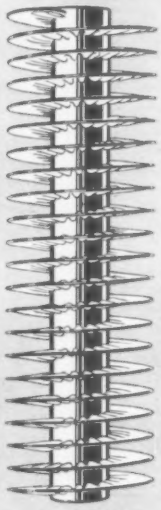

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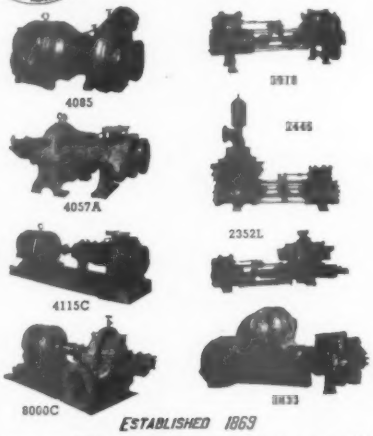

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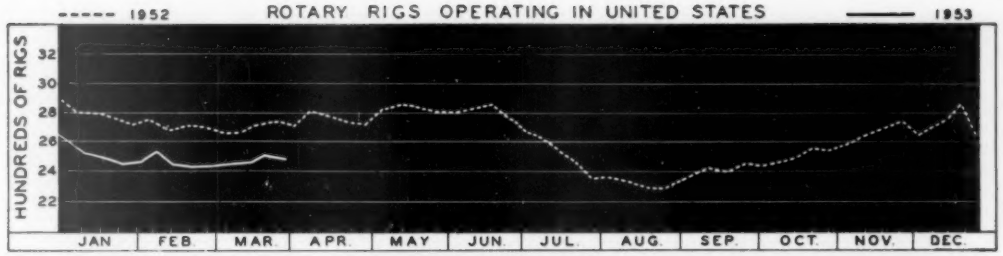
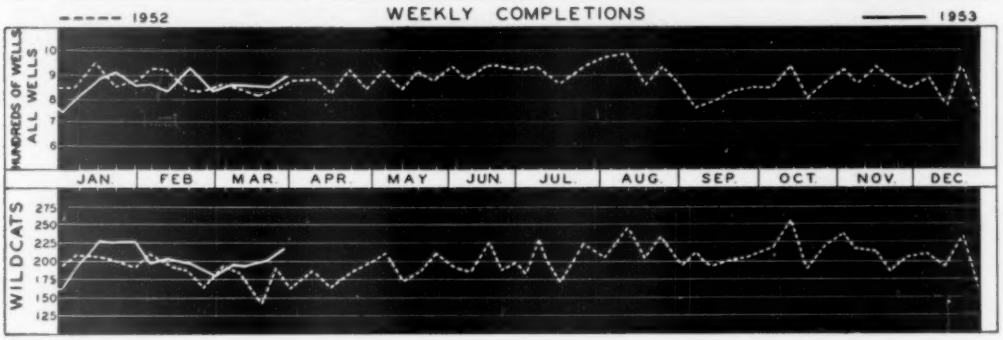




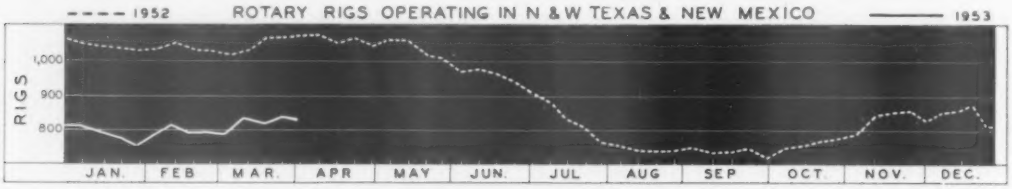
CURRENT STATISTICS

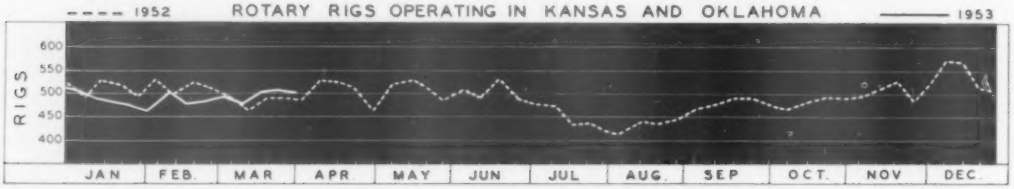
EXPLORATION

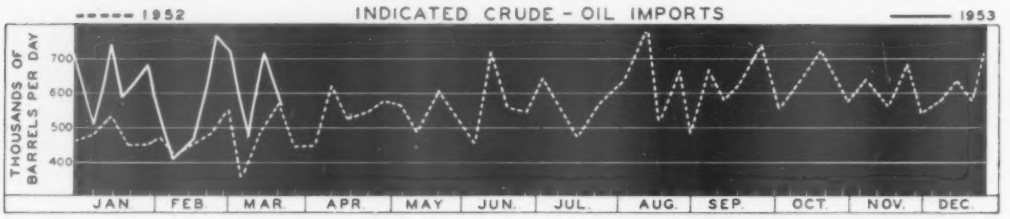
WEEKLY WELL COMPLETIONS . . . WEEK ENDED MARCH 28, 1953

	Total of all wells					Mar. 28		Wildcat completions and discoveries					Cumulative total, 1953				
	Comp.	Oil	Gas	Dry	Footage	1953	1952	Oil	Dist.	Gas	Dry	Total	Oil	Dist.	Gas	Dry	Total
New York	15	7	0	*8	20,950	156	161	0	0	0	0	0	0	0	0	0	0
Pennsylvania	35	17	3	†15	58,250	391	387	0	0	0	0	0	0	0	3	6	9
West Virginia	11	2	6	3	26,909	125	148	0	0	0	0	0	0	0	1	1	2
Ohio	20	7	1	‡12	41,512	224	221	0	0	0	1	1	1	0	0	5	6
Indiana	14	5	0	9	23,550	276	257	1	0	0	4	5	6	0	1	64	71
Kentucky	17	10	0	7	30,081	239	298	0	0	0	4	4	4	0	3	45	52
Illinois	18	8	0	10	43,050	411	359	0	0	0	3	3	1	0	0	78	79
Michigan	6	2	0	4	21,849	130	142	0	0	0	3	3	6	0	1	51	58
Kansas	97	45	11	§41	321,785	1,079	1,170	0	0	3	13	16	25	0	11	176	212
Nebraska	2	1	0	1	9,381	60	56	0	0	0	1	1	5	0	0	25	30
Oklahoma	135	91	4	40	493,393	1,589	1,467	4	0	0	16	20	20	3	6	147	176
Texas	359	191	22	146	1,654,075	3,933	4,424	21	1	8	89	119	216	18	52	985	1,271
North Central (Dist. 7-B & 9)	138	77	1	60	488,431	1,378	1,389	12	0	1	38	51	116	0	5	402	523
West (Dist. 7-C & 8)	73	50	0	23	393,481	860	1,378	4	1	0	13	18	37	2	2	153	194
Panhandle (Dist. 10)	12	4	4	4	44,916	184	181	0	0	0	1	1	0	2	0	7	9
Eastern (Dist. 5 & 6)	25	8	4	13	124,276	196	197	0	0	1	9	10	5	1	1	64	71
Gulf Coast (Dist. 2 & 3)	55	24	9	22	340,181	611	658	4	0	5	12	21	33	3	26	149	211
Southwest (Dist. 1 & 4)	56	28	4	24	262,790	704	621	1	0	1	16	18	25	10	18	210	263
Louisiana	51	23	3	25	353,929	597	560	2	0	0	12	14	16	2	5	84	107
Northern	16	8	1	7	50,302	251	301	0	0	0	2	2	1	0	0	31	32
Southern	35	15	2	18	303,627	346	259	2	0	0	10	12	15	2	5	53	75
Arkansas	9	6	0	3	41,136	105	92	1	0	0	2	3	5	0	0	22	27
Mississippi	8	2	0	6	66,361	85	108	1	0	0	5	6	6	0	1	41	48
Southeastern States	3	0	0	3	17,650	36	14	0	0	0	3	3	1	0	0	28	29
Montana	4	2	0	2	19,490	87	37	0	0	0	1	1	1	0	0	24	25
Wyoming	8	7	0	1	37,407	131	139	0	0	0	1	1	1	0	0	28	29
Colorado	4	0	1	3	19,596	110	93	0	0	0	2	2	2	0	2	65	69
Utah	4	1	0	3	25,468	22	20	0	0	0	1	1	1	0	0	14	15
New Mexico	38	12	21	5	192,153	308	223	0	0	0	2	2	5	0	4	36	45
California	41	30	0	11	204,010	583	614	2	0	0	10	12	14	0	2	135	151
North Dakota	0	0	0	0	0	56	5	0	0	0	0	0	0	0	0	12	12
Miscellaneous (Idaho)	1	0	0	1	12,720	10	15	0	0	0	1	1	0	0	0	8	8
Total United States	900	469	72	359	3,734,705	10,743	11,010	32	1	11	174	218	336	23	92	2,080	2,531
Total previous week	856	441	72	343	3,539,118			22	2	10	169	203	304	22	81	1,906	2,313
Total March 29, 1952	880	526	57	297	3,739,532			35	2	8	118	163	354	26	61	1,914	2,355

Service wells included: *8, †13, ‡4, §1.



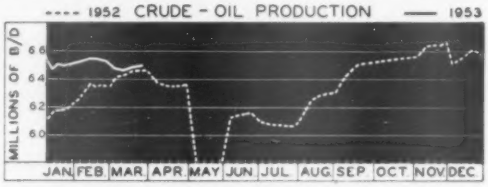


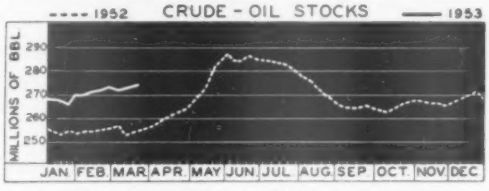


DAILY AVERAGE PRODUCTION FOR WEEK

	March 28			Mar. 21
	Crude oil	Lease condensate	Total	total
Alabama	4,500		4,500	4,400
Arkansas	76,550	650	77,200	77,450
California	992,600		992,600	992,600
Colorado	93,000		93,000	90,900
Eastern	56,000		56,000	56,000
Florida	1,475		1,475	1,475
Illinois	163,300		163,300	161,100
Indiana	33,500		33,500	33,600
Kansas	341,100		341,100	355,900
Kentucky	29,300		29,300	29,600
Louisiana	686,225	42,000	728,225	728,275
North	112,900	2,500	115,400	115,450
South	573,325	39,500	612,825	612,825
Michigan	34,500		34,500	34,700
Mississippi	92,400	4,700	97,100	97,200
Montana	32,000		32,000	32,500
Nebraska	12,500		12,500	12,800
New Mexico	180,275	600	180,875	181,275
Oklahoma	540,200		540,200	543,600
Texas	2,802,175	50,425	2,852,600	2,842,075
Dist. 1	36,800	250	37,050	37,050
Dist. 2	151,675	6,000	157,675	157,675
Dist. 3	459,075	25,700	484,775	484,775
Dist. 4	254,275	6,000	260,275	260,275
Dist. 5	48,500	500	49,000	49,000
Dist. 6	122,725	6,000	128,725	128,725
East Texas field	247,000		247,000	247,000
Dist. 7-B	104,950	100	105,050	105,050
Dist. 7-C	185,125	4,800	189,925	179,400
Dist. 8	931,325	350	931,675	931,675
Dist. 9	188,000	700	188,700	188,700
Dist. 10	72,725	25	72,750	72,750
Utah	5,000		5,000	5,000
Wyoming	209,500		209,500	202,800
North Dakota	13,000		13,000	12,500
Total U. S.	6,399,100	98,375	6,497,475	6,495,750
Change from previous week, up			1,725	
Canada	164,900		164,900	165,000
Total U. S. production January 1-March 28			566,077,825 bbl.	
Same period last year (crude plus cond.)			*556,376,995 bbl.	

*Includes 8,501,885 bbl. condensate.



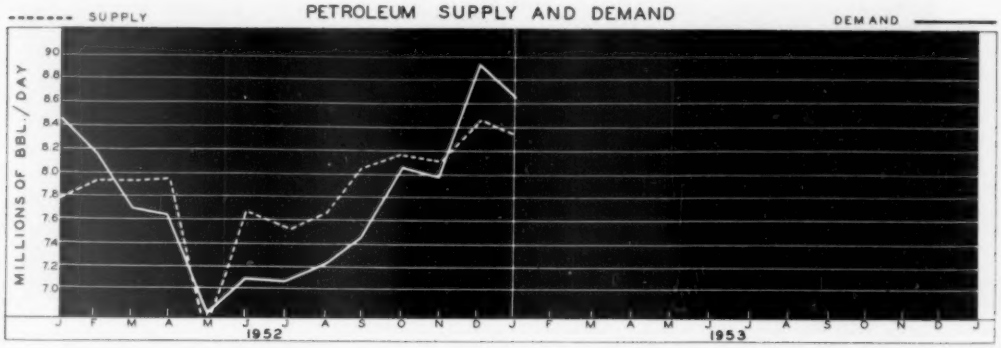


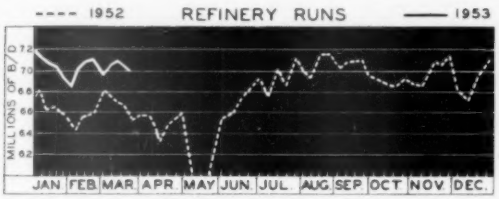
CRUDE-OIL STOCKS BY STATES OF ORIGIN*

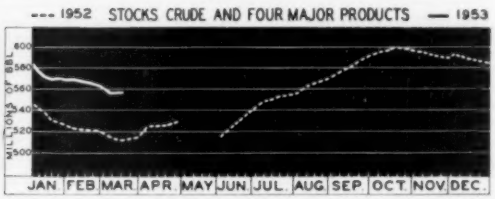
(Thousands of barrels)

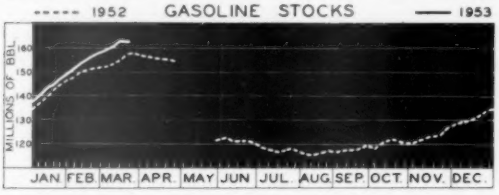
	Mar. 21, '53	Mar. 14, '53	Mar. 22, '52
Pennsylvania Grade	2,378	2,290	2,256
Other Appalachian	1,751	1,959	2,175
Illinois, Indiana, Michigan	10,493	10,755	11,318
Arkansas	2,974	2,821	2,964
Louisiana	17,075	16,972	13,841
North	3,224	3,267	2,981
Gulf	13,851	13,705	10,860
Mississippi	3,854	3,797	3,523
New Mexico	7,168	7,391	7,720
Oklahoma and Kansas	36,288	36,627	38,763
Texas	135,934	134,301	122,550
East Texas proper	11,426	10,983	11,020
West Texas	65,165	64,674	55,412
Texas Gulf	25,978	25,746	25,673
Other Texas	33,365	32,898	30,445
Rocky Mountain	16,124	15,759	13,964
California	32,780	32,869	30,004
Foreign	7,661	7,816	6,090
Total	274,480	273,357	255,168

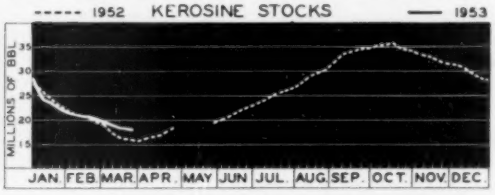
*Bureau of Mines.

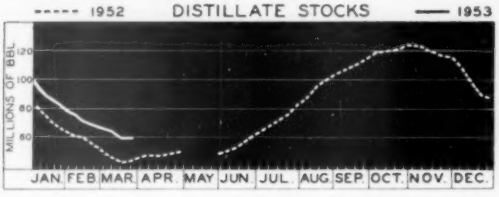


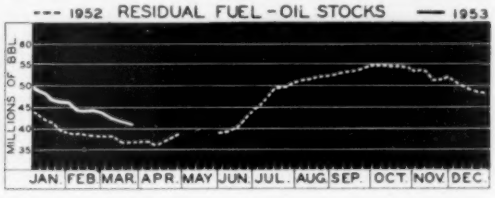










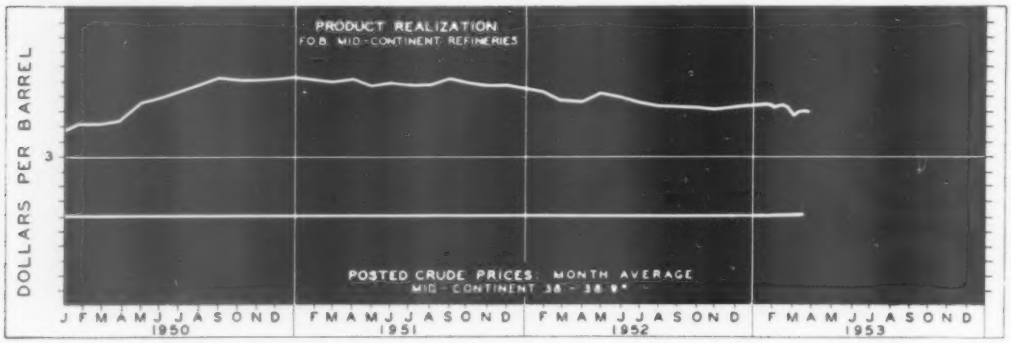


A.P.I. REFINERY REPORT, MARCH 28

(Thousands of barrels)

District—	Daily avg. runs	Daily average production—Gaso.*	Kero.	Dist.	Resid.	Stocks‡—Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, March 1952—Daily avg. runs	Daily average production—Gaso.*	Kero.	Dist.	Resid.
East Coast	1,044	371.3	30.8	257.3	229.9	34,783	8,232	19,564	9,936	940	385.3	44.3	226.6	229.6
Appalachian:														
District 1	108	46.3	6.8	19.7	14.6	4,220	398	946	438	109	49.0	5.8	14.8	13.2
District 2	101	46.1	6.0	14.4	15.2	1,823	297	394	162	71	35.2	4.2	11.6	17.6
Ind., Ill., Ky.	1,258	675.6	74.4	199.0	159.9	37,539	3,542	8,958	3,820	1,253	632.6	81.7	228.7	174.8
Okla., Kans., Mo.	585	344.3	10.3	133.0	53.9	18,992	1,130	6,465	1,097	535	293.9	18.2	119.6	63.8
Inland Texas	240	157.4	8.3	36.9	29.9	6,554	301	1,167	875	236	166.3	13.4	40.4	38.0
Texas Gulf Coast	1,760	736.6	143.0	428.9	250.3	22,140	2,069	6,956	6,566	1,705	727.0	145.4	391.6	265.2
La. Gulf Coast	550	264.9	48.6	154.7	58.7	8,240	1,365	3,978	1,286	499	240.3	49.9	143.9	59.0
N. La. and Ark.	61	24.7	4.9	7.7	10.0	3,485	455	1,028	81	71	31.6	6.7	19.2	4.9
Rocky Mountain:														
New Mexico	19	11.3		2.9	3.7	142		30	29	18	10.4	1.0	2.6	4.0
Other Rocky Mtn.	229	101.1	8.3	43.9	4.3	6,955	309	1,641	922	217	101.4	8.7	42.9	46.7
California	1,045	457.4	3.0	152.9	396.0	18,005	319	8,630	15,790	986	395.7	6.6	158.2	356.8
Mar. 28, 1953	7,000	3,237.0	344.4	1,451.3	1,266.4	162,878	18,417	59,757	41,002	6,640	3,068.8	385.9	1,400.1	1,273.6
Mar. 21, 1953	7,099	3,322.3	409.4	1,476.8	1,277.7	163,324	18,492	59,751	41,844					
Mar. 29, 1952	6,590	3,122.4	392.9	1,387.4	1,263.7	158,816	16,179	48,537	36,523					

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipe lines.


PRODUCT REALIZATION
F.O.B. MID-CONTINENT REFINERIES
DOLLARS PER BARREL
3
POSTED CRUDE PRICES: MONTH AVERAGE
MID-CONTINENT 38 - 38.9°
J F M A M J J A S O N D
1950
F M A M J J A S O N D
1951
F M A M J J A S O N D
1952
F M A M J J A S O N D
1953

In this trend chart refinery realization is based on average Mid-Continent grade crude oil (not 38° gravity only) and average prices for refinery products as published in The Oil and Gas Journal basis Oklahoma (Group 3). Refinery yields confined to gasoline, kerosine, distillate and fuel oil. Realization averaged $3.29 for week ended March 21, $3.30 for previous week, and $3.37 for March 1952. The above trend information is based on volumes and current prices and therefore does not reflect changes in operating costs.

REPRESENTATIVE QUOTATIONS

Representative spot-market quotations of leading suppliers as of April 1, 1953. Figures are f.o.b. plant for tank-car shipments in cents per gallon, except for residual fuel oil which shows the price per barrel and wax, in cents per pound.

GASOLINE, KEROSINE, AND FUEL OILS

	Mid-Continent Group 3	New York Harbor (barge)	Texas Gulf Coast
Regular gasoline, 80-82 octane	10⅛-10½	12-12.75	10½-11
Premium gasoline, 86-88 octane	11¾-11½	13.125-14	11¾-12
42-44 w.w. kerosine	8⅜-8¾	10.40-10.65	9
No. 2 straw fuel oil	7⅜-7¾	9.40-9.65	8
No. 6 residual	$0.80-1.00	$1.90-2.15	$1.50-1.65

NATURAL GASOLINE

	Group 3	North Tex.	N. La.
Grade 26-70	5½	5	5¼
Grade 18-55	6.60	6.10	6.35

LUBRICATING OILS
South Texas

200 vis., No. 2-3 neutral	12-13
750 vis., No. 3-4 neutral	15-16
2,000 No. 5-6 neutral	17-18

LUBRICATING OILS
Mid-Continent

150-160 vis., D bright stock, 0-10 pp.	21-22
200 vis., No. 3 neutral, 0-10 pp.	12-13

Western Pennsylvania

145-155 vis., 10 p.t. bright stock	26.5
180 vis., 0 p.t. neutral	29.5

WAX
Mid-Continent

132-134 A.M.P.	5.5

HIGHER quotations in the residual-fuel market at a time when demand for heavy fuel normally starts a seasonal decline seems to be based, not on current supply and demand factors, but on an expected decrease in supply in the months ahead.

The return to a $2.00 posting by some suppliers in New York harbor from quotations of $1.90 for the last of February and the first 3 weeks of March was reported to have been due to the lack of new business at the lower price rather than to any shortage of material. East Coast residual stocks on March 21 amounted to 10,407,000 bbl. compared with 9,269,000 bbl. for the corresponding date last year.

Several suppliers on the Gulf Coast increased quotations on No. 6 fuel from $1.50 to $1.60 per barrel at the end of March. Spot tanker rates have changed very little over the past several weeks.

Some suppliers are reported to be expecting a drop in residual imports over the next several months and smaller domestic production of residual due to lower refinery runs. It is normal for residual imports to decrease during the spring and summer months in response to lower demands during these months. Average domestic demand for residual fuel during the second and third quarters of 1951 and 1952 was about 400,000 bbl. daily less than in the first quarters.

Residual in the Mid-Continent changed very little during the week. Railroad purchases in the Group 3 area are reported to have been set at $0.85 a barrel for April, unchanged from March. Residual stocks in District 2 are about 1,000,000 bbl. less than a year ago.

Gasoline stocks are increasing at pipe-line terminals in the North Central states. Material is still available at 10.375 cents plus transportation for immediate delivery, but most suppliers report plans for good increases in gasoline demand this summer.

CRUDE PRICES
GRAVITY SCHEDULE

	Signal Hill, Calif‡	Okla. homa, Kansas	Gulf Coast Tex.*	West Tex.†
14-14.9	$1.87	....	....	....
15-15.9	1.93	....	....	....
16-16.9	1.99	....	....	....
17-17.9	2.05	....	....	....
18-18.9	2.11	....	....	....
19-19.9	2.18	....	....	....
20-20.9	2.24	$2.25	....	$2.12
21-21.9	2.30	2.27	....	2.14
22-22.9	2.37	2.29	....	2.16
23-23.9	2.45	2.31	....	2.18
24-24.9	2.53	2.33	$2.56	2.20
25-25.9	2.61	2.35	2.58	2.22
26-26.9	2.69	2.37	2.60	2.24
27-27.9	2.76	2.39	2.62	2.26
28-28.9	2.83	2.41	2.64	2.28
29-29.9	2.91	2.43	2.66	2.30
30-30.9	2.97	2.45	2.68	2.32
31-31.9	3.04	2.47	2.70	2.34
32-32.9	3.12	2.49	2.72	2.36
33-33.9	....	2.51	2.74	2.38
34-34.9	....	2.53	2.76	2.40
35-35.9	....	2.55	2.78	2.42
36-36.9	....	2.57	2.80	2.44
37-37.9	....	2.59	2.82	2.46
38-38.9	....	2.61	2.84	2.48
39-39.9	....	2.63	2.86	2.50
40 and above	....	2.65	2.88	2.52

*For crude from Daboval, El Campo, and Sand Point.

†Includes Lea County, New Mexico.

Last general price change represented a 50-cent increase, effective December 6, 1947.

‡Standard Oil Co. of California.

FLAT CRUDE PRICES

Representative posted schedules per barrel. Louisiana:	
Beauregard Parish	2.60
Cotton Valley (distillate)	2.85
Cotton Valley (crude)	2.70
Texas:	
East Texas	2.65
Pecos County (Yates)	2.35
Conroe	2.83
Van	2.48
Pennsylvania Grade:	
Bradford	4.40
Southwest Pennsylvania	3.97
West Virginia	39.1
Illinois Basin	2.77

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1 OILWELL Steam Pump, 16¼ x 7¾ x 20". This pump is in excellent condition, may be seen at Makin Drilling Company Yard, Hobbs, New Mexico. Makin Drilling Company, Box 1628, Hobbs, New Mexico.

2—OILWELL 3" x 6" Triplex Power Pumps w/ porcelain plungers. 7—75 HP, 440-V, 900 RPM, Open type electric motors. 13—6 groove D-section sheaves 15" to 34" diameter. 4000'—1½" Cement Lined Pipe. Morrison Producing Company, P. O. Box 712, El Dorado, Kansas.

KEYSTONE Spudder trailer mounted truck and tools. Located Washington County, Oklahoma. $1800.00. Working on well, ready to move. Box G-384, The Oil and Gas Journal, Tulsa, Oklahoma.

FOR SALE: 2—New B. J. Multiplex 6 x 8 x 10 pipe line pumps, 1000 Gal. @ 400 ft., maximum head 2000'. List $3468.00 each. Our Price $1250.00 each. Bender Oil Operations, P.O. Box 52, Bakersfield, California

14 miles 6⅝" O.D., seamless, weight 18.97, Range 2. 1½ miles 4½" O.D., seamless, weight 8.64, Range 3. All above pipe laid in 1943, clean inside, all beveled for welding, cleaned outside, located Cushing and Cleveland, Oklahoma. Guaranteed A No. 1.

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Equipment Values!

Big 20% Off Sale now in progress!

AIR COMPRESSOR — Gardner - Denver, 500 cu. ft., powered by Cat Diesel D13000 eng.; 2 yrs. old, hourmeter reads 3598. A-1 condition. FOB Louisville. **$9,885.00 Less 20%**

POWER-UNIT—Cat Diesel D13000Y, ser. #5E2010; 140 HP Diesel eng. with open type clutch. Mechanically sound—excellent buy. FOB Paducah **$3,500.00 Less 20%**

TRACTOR-DOZER—Cat Diesel D4, ser. #5T6131; std. ga. w/crankcase guard, front pull hook, heavy duty radiator guard. Has Southwest straight cable dozer, Hyster D4N towing winch with auxil. drum. Priced way below market value. FOB Louisville **$4,975.00 Less 20%**

MOTOR GRADER—Adams Diesel Model 511, ser. #1523; tandem grader with Interna. UD14 Diesel eng. Front tires, 7.50x24 10-ply, are 70% good; rear tires, 13.00x24 8-ply, about 50% of new. Has 12 ft. moldboard. Priced to move out fast. FOB Evansville **$3,375.00 Less 20%**

ENGINE - POWER UNIT — Cat Diesel D17000Y, ser. #3S1761; heavy duty V8, 190 HP Diesel eng., looks and runs good. Just serviced, ready to go. FOB Paducah **$6,725.00 Less 20%**

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WHAYNE
SUPPLY CO.
800 W. MAIN ST., LOUISVILLE, KY.
EVANSVILLE, IND. PADUCAH, KY. ASHLAND, KY.

EQUIPMENT FOR SALE

CATERPILLAR D4 Tractor with Trackson Pipelayer in excellent condition. Will rent with purchase option. Write—J. W. Kerby, Chanute, Kans.

FOR SALE: ZC 739 Fairbanks-Morse engines taken off for electrification purposes, and completely overhauled. Complete with clutch and sheave. Silvan Supply Company, Box 567, Drumright, Oklahoma.

TWO DOUBLE DRUM WILSON MOGUL SPUDDERS on steel skid, gasoline engine, butane heat exchanger, 60' single leg mast pole, dog house, electric plant, junk rack, tools. Practically new, excellent condition, ready to work. Located Grant Body and Equipment Company yard, Tulsa. Price $15,000.00 each. Phone 3-9191, Box 1896, Tulsa.

FOR SALE

Approximately 100 miles 6⅝" O.D. 18.97# Used Lapweld Line Pipe in single random lengths, plain ends beveled.
This pipe is cleaned, primed and beveled and is offered FOB Indianapolis, Indiana, subject to inspection and acceptance at location. Prices are reasonable, with special consideration to dealers.
We solicit your inquiries for all or part of this pipe, and for further information please write or call:

COMMERCIAL METALS COMPANY
P. O. Box 1046, Dallas, Texas
HUnter 4651

STANDARD PIPE SUPPLY COMPANY
P. O. Box 243, Houston, Texas
CHarter 6976

DAVIDSON PIPE COMPANY, INC.
2nd Avenue 50th St., Brooklyn 32, N. Y.
GEdney 9-6300

TEXAS PIPE & SUPPLY COMPANY
P. O. Box 1331, Houston, Texas
BLackstone 0101

EQUIPMENT FOR SALE

TWO complete GM Quads in running condition. 1000 hours since last overhaul. 60 injectors. $4000 per quad FOB Seattle. Evans Engine & Equipment Co., Inc. Distributors General Motors Diesels. 1230 Westlake North, Seattle, Washington.

WELL drilling equipment, new or used Spudders, rotaries, core & shot hole drills, tools, pipe, bits, blocks, pump jacks, valves Everything for well drilling and service Fishing tools rented. Pressey & Son, Pueblo, Colo.

Gaso Duplex 4½" x 6" Power Pumps with Chrysler C-36 Engines, skid mounted. Immediate delivery. Also Byron Jackson, Carter Centrifugal Units. Westinghouse 20-25-50 KW Generating Units.

H. H. COFFIELD
Attn.: W. H. ORR
Phones: 122—Rockdale, Texas
AT-3427—Houston, Texas

FOR SALE

Complete National 100 Rig including 3 PTD-6 Superior Diesel Engines with dual fuel equipment, 136' Lee C. Moore Mast with 8' substructure, 2 C-350 Ideal Power Pumps, Ideal Type 548 TC Traveling Block, Type R3 Swivel, and Type MS-20½ Rotary Table. Excellent condition, priced reasonable, located in Montana. Complete inventory upon request

Box G-341

The Oil and Gas Journal,
Tulsa, Oklahoma

FOREIGN A. P. I. PIPE

Immediate Delivery from Houston Stock

POPULAR SIZES, WEIGHTS and GRADES

No P.A.D. Tickets Required

Phone, Write or Wire for Prices

LUCEY PRODUCTS CORPORATION

TULSA, OKLAHOMA

624 So. Cheyenne **Phone LD - 204**

EQUIPMENT FOR SALE

FOR SALE: Gardner Denver 4½ x 5 FXF Mud Pump—Good condition. Whitlock, 2062-R, Pampa, Texas.

FOR SALE: 80,000' 4½ O.D. S.S. line, 60,000' 3½ O.D. line, 60,000' 6⅝ S.S. line. Lundquist Pipe & Supply Co., Phone 5-8850, Tulsa, P.O. Box 1215.

TWO used 5,000-barrel steel tanks located Sunburst, Montana, one in good condition, one fair. Hardrock Oil Co., Box 1242, Great Falls, Montana.

FAILING 1500 heavy duty drill with 4½ x 6 pump, automatic pulldown, and mounted on International truck. Write P. O. Box 819, Longmont, Colo. Phone 1333.

FOR SALE—Model 5000 Franks Skid Type Rotary complete with 96 foot derrick; two 200 hp Diesel Motors compounded; 7¼ x 12 Gardner-Denver Pump; with or without 5000 feet 4½" Drill Pipe. Located Central Nebraska. Box G-415, The Oil and Gas Journal, Tulsa, Oklahoma.

FOR SALE: Model R.L. 30-Drum Cardwell Spudder. Trailer Mounted, complete with all tailing-in tools. 7000 feet almost new 9/16-inch and ¾-inch lines. Will sell with or without tools. For full description and inventory, write Box G-406, The Oil and Gas Journal, Tulsa, Oklahoma.

LARGE MODEL K Cardwell with SRK Waukesha Engine with 55', 8⅝ telescoping pole. Unit fully equipped with all tools and lines. All mounted on GMC 6 x 6. All ready to work. Price $9,000.00. J. L. Chew, Lyons, Kansas.

USED EQUIPMENT for Sale: Shaffer & Regan Blowout Preventers, B.J. Hooks, Rotary Tables, Traveling Blocks & Mud Pumps. Used Drill Pipe, all Range 2, 3½" API FH w 5" OD Joints; 3½" API IF w 4¾" OD Joints; 4½" API FH w Flash Weld & Conventional Joints. Phil A. Cornell, Box 5113, Farley Station, 4200 West Reno, Oklahoma City, Oklahoma. Phone WI 2-5660.

FOR SALE

Complete steam drilling rig with 5—350 lb. Broderick boilers, 144 ft. M and M Derrick, 11 ft. sub-structure, 23-9 Ideal draw works, 2 Ideal 20" pumps, 548 TC traveling block, HS-20½ rotary table, M3 swivel, excellent condition. Complete inventory upon request. Located in Calif.

THE SUPERIOR OIL CO.
Los Angeles, California

FOR SALE

30,000' used seamless pipe—12¾" O.D.—⅜" wall—51 lb. per foot—in lengths from 17' to 40'—located in Indiana. Priced for immediate sale. Wire, write or phone.

M. E. FITERMAN CO.
2031 Railway Exchange Bldg.
St. Louis, Missouri **Garfield 2677**

FOR SALE

New at East Chicago, Indiana, 3 BS&B Catalytic Converters Complete, 4' ID x 29' Ser. #2956T1, 2 and 3, Shells ½" thick ASTM-A 70 Flg. quality steel, Tube Sheets 10¼" thick same steel, cover plates 7⅜" thick ASTM-A 212 Fire Box quality, 48—5" OD x 26' x ⅜" Seamless Tubes A-106-39 Grade "B," Shell Design Pressure 60# PSIG., Test 90# Tubes and Heads 1100# PSIG., Test 1650# Full data and price on request.

CITIES SERVICE OIL
Patridge, Bartlesville, Oklahoma

EQUIPMENT FOR SALE

FOR SALE: Moore cantilever derrick; Wilson Giant two motor draw works; two pumps, rotary; block and hook. Write Box 3246, Corpus Christi, Tex.

1—CARDWELL Q rod & tubing unit with 7 x 8 telescoping mast. Mounted on 1950 2-ton Chevrolet truck. Some tools. Write or call Kent Well Servicing Company, Phone 1068, El Dorado, Kansas.

SALES and rentals of cable drilling and fishing tools, casing and equipment, from the Southwest's largest stock of used cable tools and oil field supplies. Degen Pipe and Supply Co., Tulsa, Oklahoma.

USED ROTARY, cable tools, and production equipment. E. A. Kelly, 3131 S.E. 29th Street, P. O. Box 861, Oklahoma City. Phone Jackson 56407.

FORT WORTH, Model-D Spudder complete with International power unit, tools for 22" diameter holes, located near Los Alamos, New Mexico. Inventory furnished upon request. Texas Water Wells, Inc., 951 McCarty Drive, Houston, Texas.

JOY 300 Drilling Rig butane powered, mounted on Brockaway 6x6 truck. 3500 feet 3½ inch drill pipe. Auxiliary mud pump and butane engine as separate unit. All tools and equipment included. This rig in first-class working condition and can be seen working now. Call or write Steele Brothers, Crete, Nebraska. Phone 127.

FOR SALE: Bucyrus Erie 36L drilling machine with top to bottom tools. Excellent condition. Located at Odessa. Phone 6-5974, Box 2204, Odessa, Texas.

OIL Field Type Boiler, 125-150 hp., 300 lb. working pressure, in good usable condition. Anchor Gasoline Corporation, 714 Atlas Life Building, Tulsa, Oklahoma.

WE have available a revised list of surplus used tubular material ready for mailing. Cities Service Oil Company, Patridge, Bartlesville.

FOR SALE
at attractive prices

30,000 ft.—1" Used Oil Well Tubing @ 12c ft.
10,000 ft.—1½" Used SEAMLESS Tubing @ 20c ft.
50,000 ft.—2" 4# and 4½# LW Used Tubing @ 18c ft. and up.
15,000 ft.—3" 7.7# and 9.2# LW Used Tubing @ 50c ft. and up.
10,000 ft.—3" Used Standard Pipe T&C (practically new).
6,000 ft.—5½" OD 17# SEAMLESS Casing Range 2 and 3.
6,000 ft.—7" OD 26# SEAMLESS Casing Range 1.
All above located our yards at Butler, Pa.
5,500 ft.—7" OD 23# SEAMLESS Casing Range 2 and 3. Located at Bakersfield, California.

KEYSTONE PIPE & SUPPLY COMPANY
Butler, Pa. **Phone 3714**

NEW

Electric Motors & Starters

General Electric Company electric motors and starters, motors in original crates. All new equipment, never used. Following inventory on hand in warehouse, Fort Worth, Texas:

1. Seven (7) 1 hp., Model 5B 203A13, type B. frame, 200 #203 Shunt Wound, 115 Volts, 1750 R.P.M., Enclosure Open, Continuous Duty, DC Electric Motors.
2. Six (6) CR-4052-ALL Cat. 6932902-G-11-hp. 1-1.5, Volts 115, Amp. 9.2-12.4 Starters.
3. One (1) CR-4052-A2L Cat. 6932903 G-5-hp., Volts 115, Amp. 40 Starter.

For full detailed information and price, CALL, WRITE or WIRE

Purchasing Department

Mid-Continent Supply Co.
Box 189 **Fort Worth, Texas**

EQUIPMENT FOR SALE

GAS METERS FOR SALE. Westcott, Foxboro and Emco. Good condition. Geo. R Milner, Box 124, Okmulgee, Oklahoma.

FOR SALE: One Barrel Type Ethyl Lead Plant, Hutex Oil & Refining Company, P. O. Box 2146, Houston, Texas.

EQUIPMENT FOR SALE: 500 KW operating 480 volt power plant complete with 2 Worthington 300 HP type GG-5 vertical 4 cycle gas engines, 1 Worthington 150 HP type BG-5 gas engine, 2 General Electric 200 KW generators, 1 General Electric 100 KW generator, 1 General Electric 5 KW exciter, and General Electric switchboard. American Liberty Oil Company, Box 1011, Mt. Pleasant, Texas.

FOR SALE: Mayhew #1000 Drilling Unit in good condition with auxiliary pump motor all mounted on 1½ ton Chevrolet Truck. Ready for immediate field operation. Will sell with 170 feet of pipe, with or without water truck. If interested write Box 336 or Call 1555-J, Monahans, Texas.

FOR SALE: 85,000' 2⅜" EUE, 4.70# R-2 Seamless used Tubing all tested to 2000#, also quantities of used Seamless and Lapweld Casing. Sabine Pipe & Supply Co. Phones 3094, 3095, 5533, Kilgore, Texas.

FOR SALE: 8—Shriver 42"x42" cast iron Filter Presses, Plate & Frame type, 18, 27, and 54 chambers, 1" cake; 15—Sperry 18"x18" cast iron Filter Presses, 11 chambers; 2—#12 Sweetland Filters fo. 36 leaves on 4" centers. Immediate shipment. Attractively priced. Consolidated Products Co., Inc., 17-20 Park Row, New York 38, N. Y. BArclay 7-0600.

STORAGE TANKS—FOR SALE: Three—55,000 bbl. steel tanks with steel roofs. Jimmy Heath, Henrietta, Texas.

FOR SALE: R. L. Dubbledrum Cardwell fully equipped. Oklahoma City, Oklahoma. Melrose 8-5108.

WANT EQUIPMENT: Did you find the equipment you wish to purchase in this column? If not, use an "Equipment Wanted" classified advertisement to find it. It is available somewhere and Journal classified advertisements will find it. See box heading for classified rates, or write The Oil and Gas Journal.

EQUIPMENT WANTED

WANTED: Three engine compound for Wilson Titan drawworks. Makin Drilling Company, Box 1628, Phone 3-3141, Hobbs, New Mexico.

WANTED: One Thrible Jack-knife and substructure. No Junk Wanted. Makin Drilling Company, Phone 3-3141, Hobbs, New Mexico.

WILL PAY highest prices for used casing, used line pipe, abandoned leases, or other surplus lease equipment. Your idle producing equipment is worth dollars. Green Pipe & Supply Co., Box 1383, Tulsa, Oklahoma.

WANTED to buy, small vacuum tower and other vacuum equipment. Box G-382, The Oil and Gas Journal, Tulsa, Oklahoma.

ONE OR MORE complete Hyd-Robot Podbielniak low temperature distillation units wanted. Box G-417, The Oil and Gas Journal, Tulsa, Oklahoma.

EQUIPMENT NOT IN USE: Did you find a buyer in this column for the equipment you have for sale? Someone wants it and an "Equipment For Sale" classified advertisement in the Journal will find a buyer. See box heading for classified rates or write The Oil and Gas Journal.

HELP WANTED

FOREIGN EMPLOYMENT. List of oil companies and drilling contractors showing where to apply for foreign jobs. OIML Co., Box 2603, Tulsa, Okla. $5.00 cash.

CHEMICAL or Petroleum Engineer for work in natural gas and gasoline field with a progressive independent in Permian basin area of West Texas. Experience desirable but not required. Salary commensurate with ability. Include education and complete brief of experience with salary expected in first reply. Replies confidential. Box G-419, The Oil and Gas Journal, Tulsa, Oklahoma.

HELP WANTED

SOUTH AMERICA. These jobs are with one of the better oil companies. Our fee paid. Mechanical Engineer—graduate, no experience required. Petroleum Engineer—graduate, no experience required. Chemical Engineer—graduate, no experience required. Mud Technician—two or more years' experience, single. Accountant—college graduate, Accounting major, single. All information confidential and should be mailed to CHAS. J. LOVELESS PERSONNEL SERVICE, 616 S. Main, Tulsa, Oklahoma. Phone 3-5168.

CANADIAN Sales Representative contacting pipe-line companies and contractors for pipe-line equipment and materials. Box G-411, The Oil and Gas Journal, Tulsa, Oklahoma.

EQUIPMENT INSPECTION ENGINEERS SOUTH AMERICA

A major oil company affiliated with Standard Oil Company (N.J.) requires graduate engineers with several years refining process equipment inspection experience. Must be qualified to interpret codes and specifications and predict equipment renewals and recommend replacement equipment.

Write giving age, marital status, education and full details of experience.

Box 308-D
Radio City Station
New York 19, N. Y.

FOREIGN SERVICE

Empresa Colombiana de Petróleos at El Centro, Colombia, on the De Mares Concession, has immediate opening for:

Chief Exploration Geologist

Proficient manager and organizer with extensive experience in finding oil by surface and geophysical methods. Duties will include developing an exploration department and recommending exploration tests on the De Mares Concession with an area of 1,250,000 acres.

Write giving full particulars of personal history and work experience. Please include telephone number.

Replies confidential

Box G-412

The Oil and Gas Journal

Tulsa, Oklahoma

HELP WANTED

PROCESS DESIGN ENGINEERS

•

A major engineering and contracting company requires Process Design Engineers with M.S. degrees in Chemical Engineering with 1 to 3 years of experience in process design of oil refinery and petrochemical plants.

Excellent opportunities for advancement and professional growth.

Reply giving details of education, experience and salary requirements. Replies will be held in strict confidence.

•

ARTHUR G. McKEE & CO.

2300 CHESTER AVE.

CLEVELAND 1, OHIO

HELP WANTED

PETROLEUM ENGINEERS & GEOLOGISTS: Rocky Mtn. positions with Majors and Independents. Need specialists in drilling, production, reservoir. Also process engrs. and refinry supts. Professional Placement Service, 516 University Bldg., Denver, Colorado.

GRADUATE engineers with gasoline plant experience qualifying them for supervisory and staff positions needed for Venezuela. Write The Carter Oil Company, Box 801, Tulsa, Oklahoma, giving age, education, marital status, and experience. Box G-368, The Oil and Gas Journal, Tulsa, Oklahoma.

CIVIL and Mechanical Engineers Piping and Structural Draftsmen for positions with Major Oil Company in Refinery Engineering Department, located in Tulsa. State qualifications and salary expected. Write Personnel Department, Post Office Box 381, Tulsa 2, Oklahoma.

THE University of Tulsa has an opening for a qualified faculty member with masters or substantial experience. Reasonable salary and opportunity for consulting and research. If interested contact Head of Petroleum Production Engineering Department, Tulsa, Oklahoma.

SEISMIC PERSONNEL needed for United States and Canada by well known and expanding contract geophysical company. Address Box E-863, The Oil and Gas Journal, Tulsa, Oklahoma.

INDEPENDENT gas producer needs experienced production superintendent familiar with drilling, completions and producing operations in East Texas and North Louisiana. Replies confidential. Box G-388, The Oil and Gas Journal, Tulsa, Oklahoma.

OIL Industry Employment Service, 405 Tuloma Bldg., Tulsa, Okla. 4-5974. Tom Robinson, owner. For Technical and Trained Personnel, including LPG.

DIVISION GEOPHYSICIST—Position open. Good salary. Require well qualified geophysicist, with geological education or training, and at least three years' experience in Permian Basin. Write:—Union Oil Company of California, 200 Wilkinson-Foster Building, Midland, Texas. Attention:—Mr. H. L. Swords.

PETROLEUM GEOLOGIST: About 35 years of age who has had experience in Permian and Pennsylvanian areas, as in West Central and North Texas, Oklahoma and Kansas, both subsurface and surface. Will headquarter in Fort Worth but must be willing to be away from home a reasonable amount of time. Give details of education, experience and salary expected. HILL & HILL, Attention: R. R. Thompson, Geologist, 1325 Forth Worth National Bank Building, Fort Worth 2, Texas.

WANTED—Good production man for large Kentucky Water flood project. Reply to Box G-416, The Oil and Gas Journal, Tulsa, Oklahoma.

EXPLORATION GEOLOGISTS SOUTH AMERICA

Major oil company affiliated with Standard Oil Company (N.J.) has attractive staff positions available for qualified geologists. Assignments cover surface, sub-surface and/or development geology.

Write giving age, marital status, education, and details of experience.

Box 308-E

Radio City Station

New York 19, N. Y.

HELP WANTED

WANTED by Independent Consultant and Service Organization: Recent graduate Petroleum or Geological Engineer. Principal duties in core analysis work. In reply please advise educational background and salary expected. P. O. Box 1939, Abilene, Texas.

MASTER Mechanic, qualified to install and maintain large diesel engines as well as pumps and accessory equipment on pipe line. Must be capable of organizing and directing maintenance program. Location, North Central Area. Please include experience and salary expected in reply. Box G-380, The Oil and Gas Journal, Tulsa, Oklahoma.

THE POSITION YOU WANT: Oil industry companies are looking for men to fill every conceivable kind of position. If you didn't find the position in this column that you are looking for, use a "Situation Wanted" classified advertisement to state your qualifications. Some company is probably looking for your ability. See box heading for classified rates or write The Oil and Gas Journal.

SITUATIONS WANTED

EXPERIENCED oil operator wants to represent parties planning active drilling program in Texas, retainer and interest basis. Bank references. Box G-383, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGIST — 32, family, seven years thorough major company exploration experience geology and geophysics, both field and home office prospect finding and evaluation, wants job with independent company Rocky Mountain Area. Box G-397, The Oil and Gas Journal, Tulsa, Oklahoma.

OIL Refinery Sup't Available. Prefer Marine, Bulk Station or Pipeline Terminal Supervision. Age 50. Box G-396, The Oil and Gas Journal, Tulsa, Oklahoma.

ATTENTION: Well established oil well drilling contractor desires to manage and supervise Individuals', groups', small or medium-sized oil companies' drilling, production and operating problems in Central and Western Texas, and New Mexico. Personal interview by appointment is desired. Makin Drilling Company, Box No. 1628, Ph. No. 3-3141, Hobbs, New Mexico.

EXECUTIVE Secretary; Extensive oil and legal experience. Prefer small office. Box G-395, The Oil and Gas Journal, Tulsa, Okla.

OFFICE MANAGER. Accountant, Executive Assistant, age 35. Familiar operation medium sized oil production and exploration company. Wish to relocate 150 miles radius Dallas, Texas. Box G-418, The Oil and Gas Journal, Tulsa, Oklahoma.

PETROLEUM Engineer: 8 years varied production, drilling and workover experience. Desires change. Will consider any location. Box G-414, The Oil and Gas Journal, Tulsa, Oklahoma.

COLLEGE graduate, age 39, married, 15 years experience drilling and production management with contractors and majors Gulf Coast Area. Desires permanent position with growing organization. Box G-405, The Oil and Gas Journal, Tulsa, Oklahoma.

PRODUCTION Superintendent — Desires change. 15 years' experience West Texas and New Mexico. Interested Lea County, New Mexico, or adjacent area. Box G-407, The Oil and Gas Journal, Tulsa, Oklahoma.

CHIEF Geologist, independent oil company desires position with independent or small major. Location open. Box G-413, The Oil and Gas Journal, Tulsa, Oklahoma.

REFINERY SUPERINTENDENT: Six years experience as superintendent; thirteen years engineering, laboratory, and general refinery experience. Petroleum refining graduate. Interested in positions of equivalent ratings. Box G-410, The Oil and Gas Journal, Tulsa, Oklahoma.

THE RIGHT MAN: Can you fill the position you have open from the qualifications listed in this column? Men are always looking for an opportunity to improve themselves. Use a "Help Wanted" Journal classified advertisement to find the men you need. See box heading for classified rates or write The Oil and Gas Journal.

REAL ESTATE

COMMERCIAL Sites (100 x 235 ft.), Residential lots (75 x 140 ft.) on Highway 83 just north of Minot (restricted to new construction). L. A. Joyce, Box 575, Dial 37-127, Minot, North Dakota.

SPACE IS NEEDED: A Journal display classified advertisement is the quickest way to rent or sell your real estate. In the present period of expansion oil industry firms urgently need the space you have available. If it isn't listed here, you may also find it by stating your needs in these pages. For classified rates see box heading or write The Oil and Gas Journal.

PUBLICATIONS

YOU CAN keep abreast of the world's economic situation with "The Rahn Journal." A keen, specific monthly analysis of business & market trends for $10.00 a year. Write P. O. Box 417, El Paso, Texas.

PRODUCTION WANTED

INDEPENDENT Oil Company desires to purchase production amounting to at least 1,000 barrels per day. Submit full details, together with competent engineering report. Confidential. Box G-404, The Oil and Gas Journal, Tulsa, Oklahoma.

BUSINESS OPPORTUNITIES

FOR SALE: 66 potential acres mining claims.Various mining districts of Fairplay, Colorado. Box G-408, The Oil and Gas Journal, Tulsa, Oklahoma.

DRILLING DEAL WANTED

Have spudders, labor, cash and repressuring experience. Would like to make drilling deal on shallow repressuring project for part cash and interest.

Box G-403, The Oil and Gas Journal, Tulsa, Oklahoma

LEASE AND DRILLING BLOCKS

DALLAM COUNTY, TEXAS: 8000 acres solid block one owner. 1/8 County leased to Major Companies. $1.25 bonus, $1.00 rentals, 10 year commercial lease. Combest Royalty Company, Amarillo, Texas.

SEE A. L. Bowles, Rollow Building, Ada, Oklahoma, for drilling deals.

5000 ACRES-2800 acres GRAY COUNTY, TEXAS, Semi-proven oil and gas 3000 Small cash bonus and little override. 5 year commercial lease $1.00 rentals. Combest Royalty Co., Amarillo, Texas.

S. E. NEW MEXICO POTENTIAL OIL FIELD

Well to drill offset to S. I. well. Two indicated productive zones in Permian. Recommend participation this important area. Complete technical report on request.

W. J. PETERMAN, Geologist
Portales **New Mexico**

LEASES ROYALTIES

Producing and Nonproducing
Bought and Sold—Any Area
Inquiries Invited

B. D. BUCKLEY
6635 Delmar Ave., St. Louis 5, Mo.

DRILLING PROPOSITIONS WANTED

Am ready to cut a few more holes. Will drill proven; semi-proven or wildcat. Submit complete information, including geology, if available. All propositions held strictly confidential. **Box G-376, The Oil and Gas Journal, Tulsa, Oklahoma.**

BUSINESS OPPORTUNITIES

AVAILABLE
OIL DEVELOPMENT
CAPITAL

We represent a client who is interested in investing in OIL AND GAS LEASEHOLDS with development merit. Locations of leaseholds, drilling requirements, and present method of operation, if any, should accompany all submittals. Mail all submittals to Attorneys, Box G-409,

THE OIL AND GAS JOURNAL

Tulsa, Oklahoma

LEASE AND DRILLING BLOCKS

WILL pay cash instantly for leases (large blocks), royalties, mineral deeds, production. Write fully—P. O. Box 2153, Denver, Colorado.

ROYALTIES

PRODUCING ROYALTY and overrides for sale. Wire-write-call for particulars. JACK EAGLE, 706 City Natl. Bldg., Okla. City, Okla. REgent 6-7027.

QUICK CASH: Producing royalties, Overrides or Production . . . no delay. Phone 72-4533, Robert L. Kinkaid . . . P.O. Box 26, Tulsa, Oklahoma.

GET TOGETHER: Both Capital and Royalties are available. If the investment proposition you want isn't listed in this column, use a Journal classified advertisement to find it. See box heading for classified rates, or write The Oil and Gas Journal.

ROYALTIES WANTED
Producing Royalties
High Grade Only
Send Full Particulars
Address
C. C. HARMON
719 World Bldg., Tulsa, Okla.
P.O. Box 2151

OIL SHOW HOUSING

MODERN PRIVATE three and four bedroom homes for rent during Oil Show. Conveniently located. Complete occupancy. Prefer 10 day contracts. Contact Sam Morrow, Phone 64021, 1815 East 17th St., Tulsa.

INSURANCE

COMPLETE INSURANCE protection for your operation and employees. The most helpful coverage & claim service. Contact John R. Braue, P. O. Box 967, Phone 4-4842, Midland, Texas.

FOR SALE—MAPS

WILDCAT MAPS

PERMIAN BASIN of W. Tex. and S.E. N. Mex.
or
WILLISTON BASIN—U. S. and Canada
Complete coverage, up-to-date wildcat operations. Over-all dimensions 26" x 28". **$3.50 per copy.**

Midland Map Company
Dept. A. Box 1211 Midland, Texas

LEGAL

THE DIRECTOR, BUREAU OF LAND MANAGEMENT, U. S. DEPARTMENT OF THE INTERIOR, Washington 25, D. C., subject to the provisions of Public Land Order 860 of August 12, 1952, offers through sealed bids at a cash bonus per acre, an oil and gas lease for 212.24 acres within the Smolan oil field and comprising the warehouse site of the Smoky Hill Air Force Base, Saline County, Kansas. Bids are to be opened in the office of the Director at 1 p.m., E.S.T., May 6, 1953. Copies of the form of lease and complete information will be mailed upon request or may be obtained from the oil and gas supervisor, U. S. Geological Survey, Post Office Building, Tulsa, Oklahoma. Each bidder must submit 1/5 of the amount bid in cash, or certified check, or money order, payable to the Treasurer of the United States. Envelopes containing bids should be plainly marked that they are not to be opened before the date and hour set out herein and should show the area involved in this sale. The lease will provide for a royalty of 12½ per cent and an annual rental or minimum royalty of $1 per acre. Prior to issuance of the lease the successful bidder will be required to pay the remainder of the bonus and the first year's annual rental, to furnish an acceptable surety bond in the sum of $15,000, and to qualify as to citizenship as prescribed for leases under the Mineral Leasing Act of August 8, 1946 (60 Stat. 950, 30 U.S.C. 181). The Department reserves the right to reject any and all bids.

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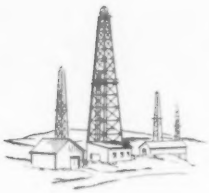
Dallas Tank Expands Board of Directors

According to W. W. Banks, president and chairman of the board, Dallas Tank Co., Inc., four members have been added to the company's board of directors. Elected as directors at the recent annual meeting of stockholders were: M. V. Reed, J. W. Banks, T. J. Tennison, Jr., and E. O. Haltom. At the same time E. O. Haltom was elevated to the vice presidency as manager of sales.

Other company officials are: M. V. Reed, executive vice president; Banks, vice president, L.P.G. division; Tennison, vice president, assistant secretary and treasurer; and Mrs. Sue Gibbons, secretary-treasurer.

LEGAL

Sealed bids for oil and gas mining leases on 4,368.12 acres of trust lands on the Crow Indian Reservation, Big Horn County, State of Montana, will be received at the Office of the Superintendent, Crow Indian Agency, Crow Agency, Montana, up to 2:00 o'clock P. M., Mountain Standard Time, April 10, 1953. For further information, call or write L. C. Lippert, Superintendent, Crow Agency, Crow Agency, Montana.



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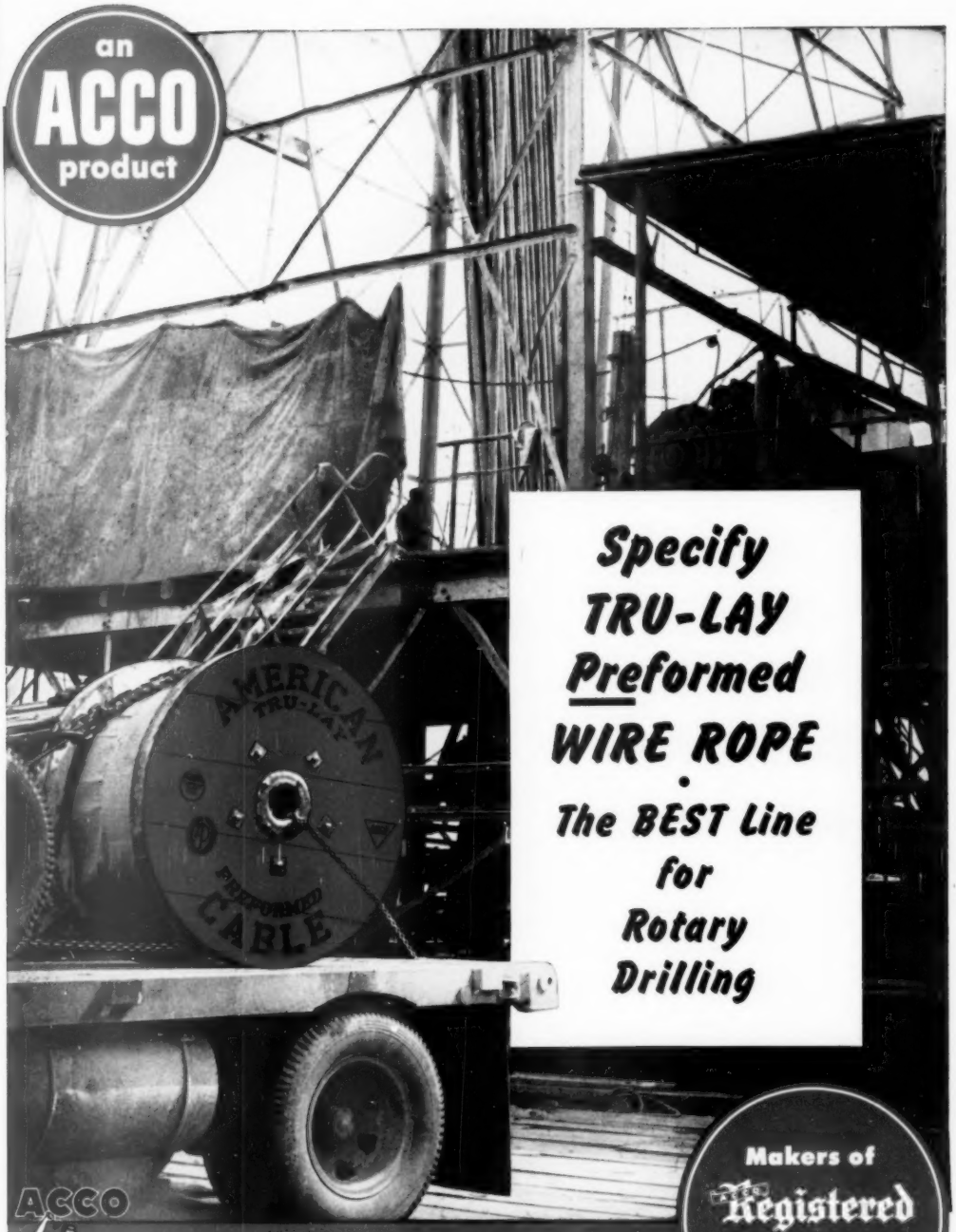

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